North American Dräger

Narkomed Mobile Service Manual Table of Contents

Summary of what's new in Revision A

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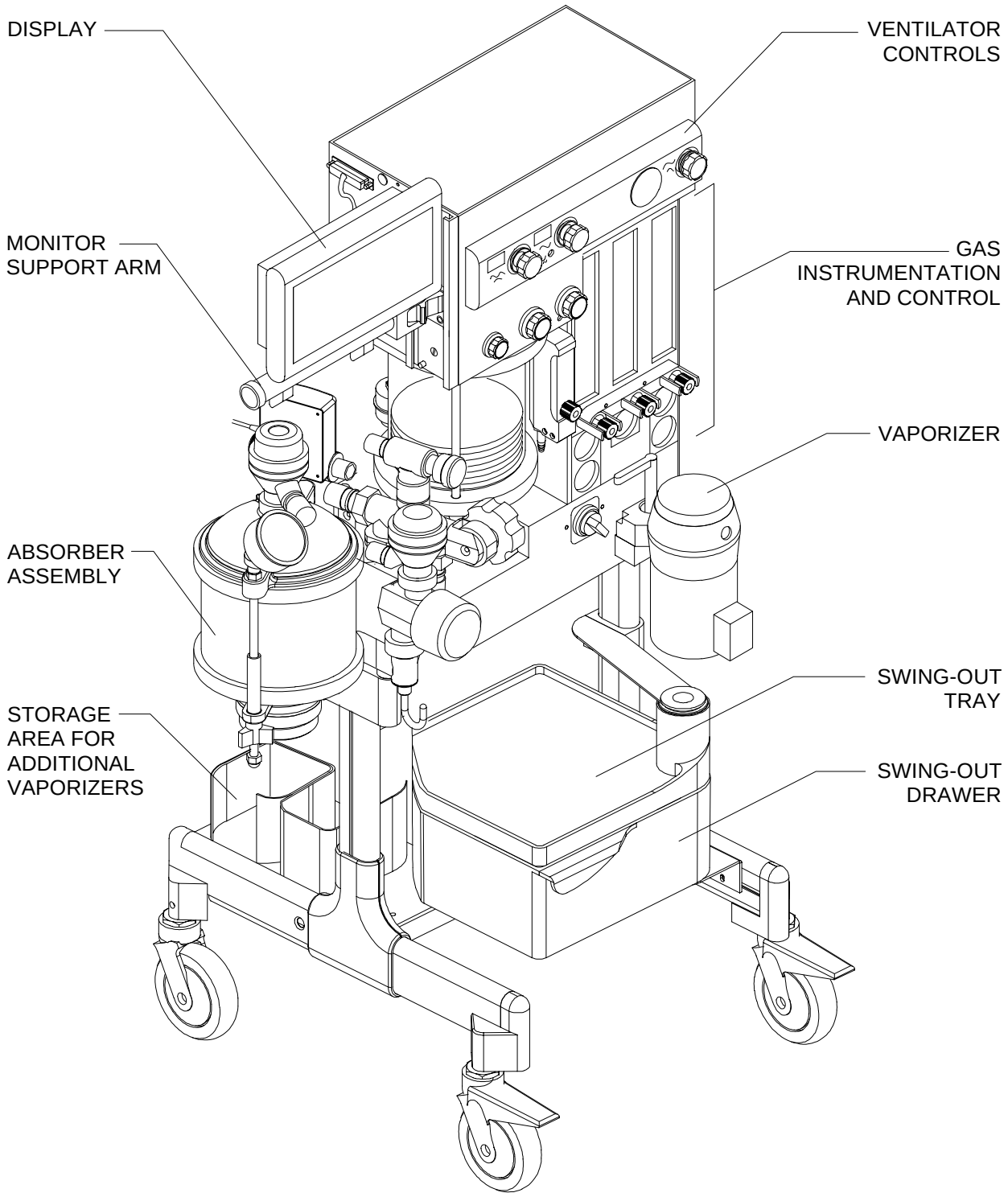
Narkomed M Mobile Anesthesia System



General Safety Precautions

The following are general safety precautions that apply during servicing of the equipment covered by this manual. These precautions are repeated elsewhere in this manual where needed.

WARNINGS indicate conditions or practices which if not strictly observed could result in personal injury.

CAUTIONS indicate conditions or practices which if not strictly observed or remedied could result in damage to the equipment.

WARNING: Ensure that AC power is removed from the machine before removing the power supply. Failure to observe this precaution may cause injury by electric shock.

WARNING: Possible explosive hazard if used in the presence of flammable anesthetics.

CAUTION: The flow tube must be properly centered over the guide rings or damage to the flow tube may occur.

CAUTION: Do not over-tighten the retainer. Over-tightening the retainer may break the flowmeter tube.

CAUTION: The controller circuit board contains static sensitive devices. Use ESD protection when handling the controller assembly. Static discharge can damage components on the circuit board.

CAUTION: The processor board contains static sensitive devices. Use ESD protection when handling the processor assembly. Static discharge can damage components on the circuit board.

CAUTION: Observe wiring colors and polarity markings to ensure that the battery is connected correctly. Connecting the battery with reversed polarity may damage the circuitry.

CAUTION: Always operate machine on level surface. Before moving the machine, remove vaporizer, remove items from top shelf and display arm, secure absorber against left side of machine.

1.0 Introduction

1.1 Purpose

This manual provides the information needed to field service and maintain the Narkomed Mobile anesthesia system. The DIAGNOSTICS section describes self-test and service diagnostics for checking the system functions. An understanding of the on-board service capabilities is necessary before any attempt is made to troubleshoot the unit. The TROUBLESHOOTING section shows the electrical distribution scheme and provides troubleshooting guides to assist the TSR in locating the source of a problem. The REPLACEMENT PROCEDURES section contains instructions for removal and replacement of the assemblies that are considered field-replaceable. The ADJUSTMENT AND CALIBRATION PROCEDURES section contains the field procedures needed to restore original system specifications. The Periodic Manufacturer's Service (PMS) PROCEDURE section outlines the steps required to verify the electrical, mechanical and pneumatic safety of the unit and also identifies components requiring periodic replacement.

1.2 Recommendations

Because of the sophisticated nature of North American Dräger anesthesia equipment and its critical importance in the operating room setting, it is highly recommended that only appropriately trained and experienced professionals be permitted to service and maintain this equipment. Please contact North American Dräger's Technical Service Department at (800) 543-5047 for service of this equipment.

North American Dräger also recommends that its anesthesia equipment be serviced at three-month intervals. Periodic Manufacturer's Service Agreements are available for equipment manufactured by North American Dräger. For further information concerning these agreements, please contact us at (800) 543-5047.

North American Dräger products/material in need of factory repair shall be sent to:

North American Dräger
Technical Service Department
3124 Commerce Drive
Telford, PA 18969
(Include RMA Number)

1.3 General Troubleshooting Guidelines

Troubleshooting the Narkomed Mobile should always begin by communicating with those who observed or experienced a problem with the unit. This may eliminate unnecessary troubleshooting steps. Once a general problem is identified, refer to the troubleshooting flow charts in Section 3 to determine the proper corrective action to be taken.

After a component has been replaced, verify that the unit is operating properly by running the appropriate diagnostic procedure. The PMS PROCEDURE in Section 6 must also be performed after any component has been replaced.

1.4 Related Publications

Narkomed Mobile Setup and Installation Manual, Part Number 4115139-001

Narkomed Mobile Operator's Manual, Part Number 4115139-001

1.5 Symbol Definitions

CAUTION: Refer to accompanying documents before operating equipment.

CAUTION: Risk of electric shock. Do not remove cover. Refer servicing to a qualified technical service representative.

Degree of protection against electric shock: Type B.

2.0 Diagnostics

The Narkomed Mobile contains a diagnostic system that monitors certain system functions and records their operational status. Following a brief System Startup display at power up, the diagnostics screen shown in Figure 2-1 appears. This display includes one of three messages at the completion of the diagnostics

FUNCTIONAL: This message indicates that the Narkomed Mobile has passed all power-up tests and is fully functional. The machine will proceed to the MACHINE MONITOR screen after a short delay.

CONDITIONALLY FUNCTIONAL: This message indicates that a minor problem has been detected. The screen will retain this display until any key is pressed, then the MACHINE MONITOR screen will be displayed.

NON-FUNCTIONAL: this message indicates that a serious problem has been detected. The machine will not proceed into the MACHINE MONITOR or SYSTEM MONITOR screen.

The PREVENTIVE MAINTENANCE DUE message will appear on the screen if the current date exceeds the Periodic Manufacturer's Service due date stored in the machine.

Further diagnostic functions are available through service screens that can be called up at the display panel. The following paragraphs provide a description of each service screen that can be accessed at the display. If no display is present upon system power-up, refer to Section 3 of this manual for troubleshooting assistance.

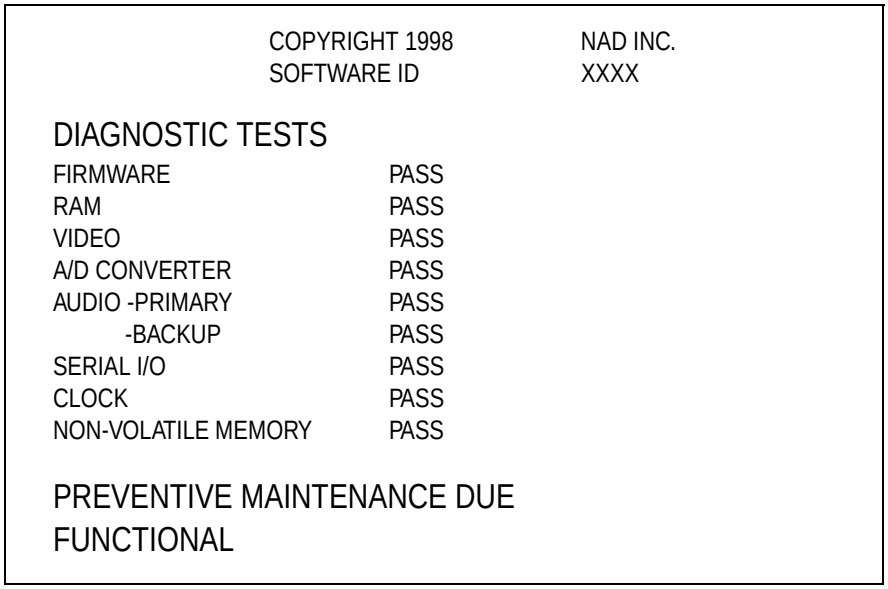


Figure 2-1. Power-Up Diagnostics Screen

2.1 Main Service Screen

2.1.1 View Mode

The Main Service Screen displays the machine serial number, the last service date, hours run since last service and total hours run.

To access the Main Service Screen, press and hold the Oxygen High Limit and Volume Low Limit keys, and press the ▲ key. The View Mode service screen shown in Figure 2-2 will then appear.

Press the ▲ key to proceed to the Service Mode as shown in Figure 2-3, or press the key next to EXIT to return to the monitoring screen.

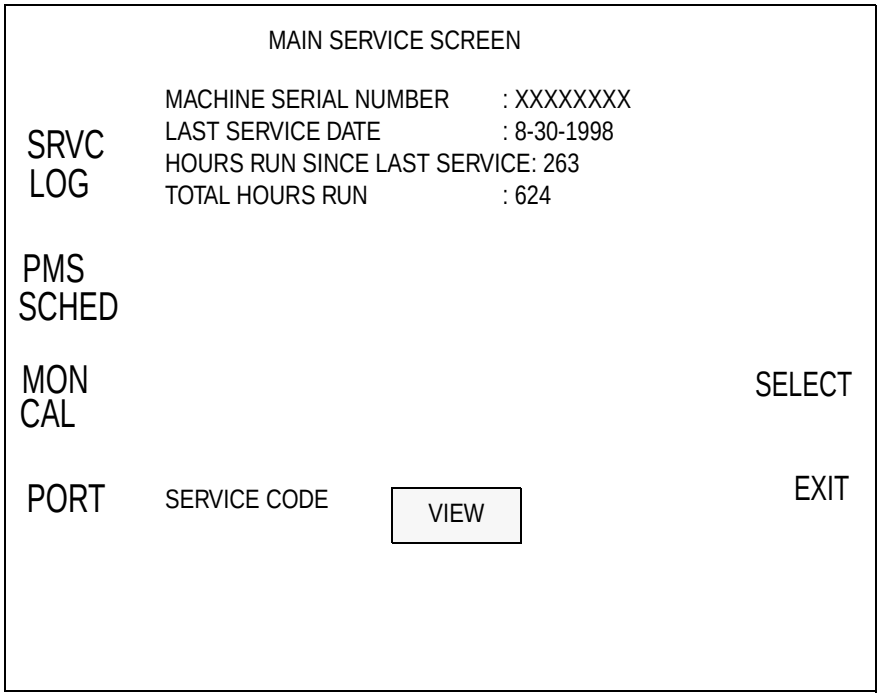


Figure 2-2. Main Service Screen, View Mode

2.1.2 Service Mode

In this screen, the Service Code changes to SRVC.

Press the key next to SELECT to enable the Technical Service ID entry as described on the next page.

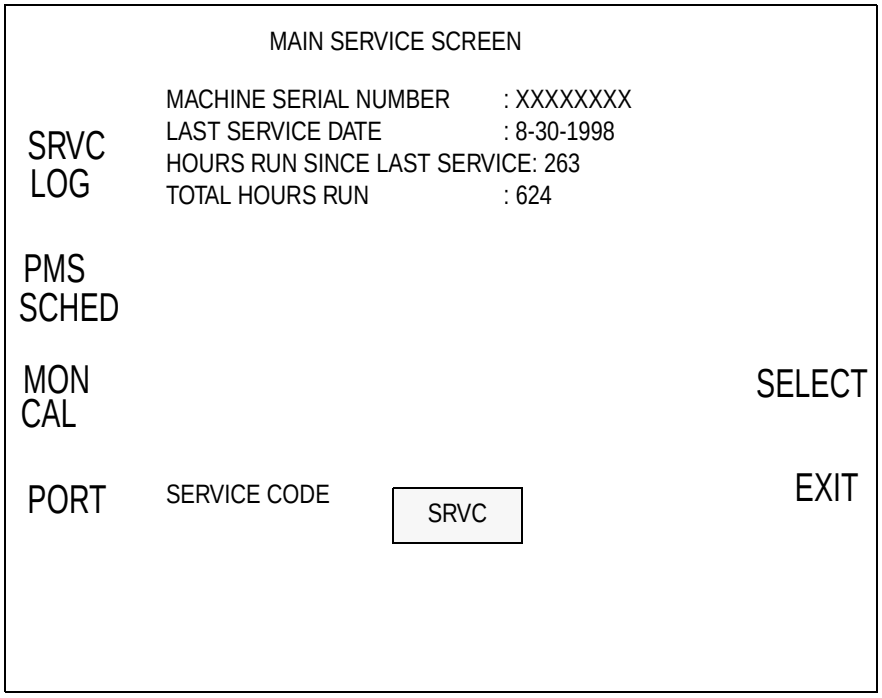


Figure 2-3. Main Service Screen, Service Mode

2.1.3 Service Mode: I.D. Entry

The Service Mode screen appears as shown in Figure 2-4. Press the key next to SELECT. Enter the first digit of your service code by using the ▲ and ▼ keys to display the desired character. Press the key next to SELECT to advance to the next digit, and enter the next and remaining I.D. characters in the same manner.

When this screen is entered, an entry is made in the Service Log.

To access any of the other service screens described on the following pages, press the key next to the desired function on the left side of the screen: Service Log, PMS Schedule, Monitor Calibration, or Port communication settings.

Pressing the key next to RESET will reset the HOURS RUN SINCE LAST SERVICE to zero, and the LAST SERVICE DATE to the current date.

If desired, press the key next to EXIT to return to the monitoring screen.

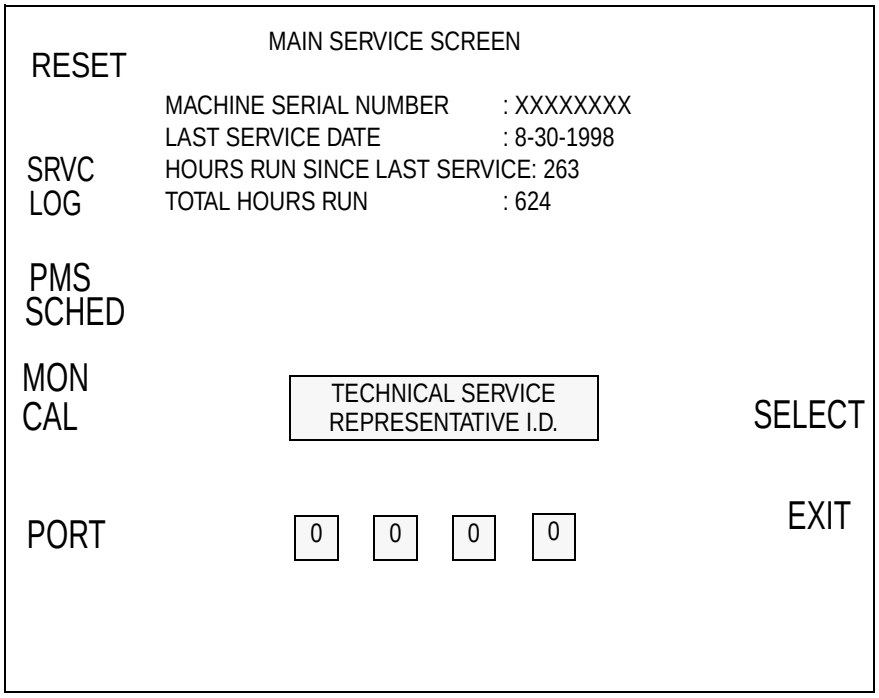


Figure 2-4. Main Service Screen, ID Entry

2.2 Service Log

From the Service Screen (described earlier), press the key next to SRVC LOG.

Figure 2-5 shows an example of the screen that will appear. This screen allows you to view the events recorded in the machine's service log. Use the ▼ and ▲ keys to scroll down or up through the log entries.

Press the key next to EXIT to return to the Main Service Screen.

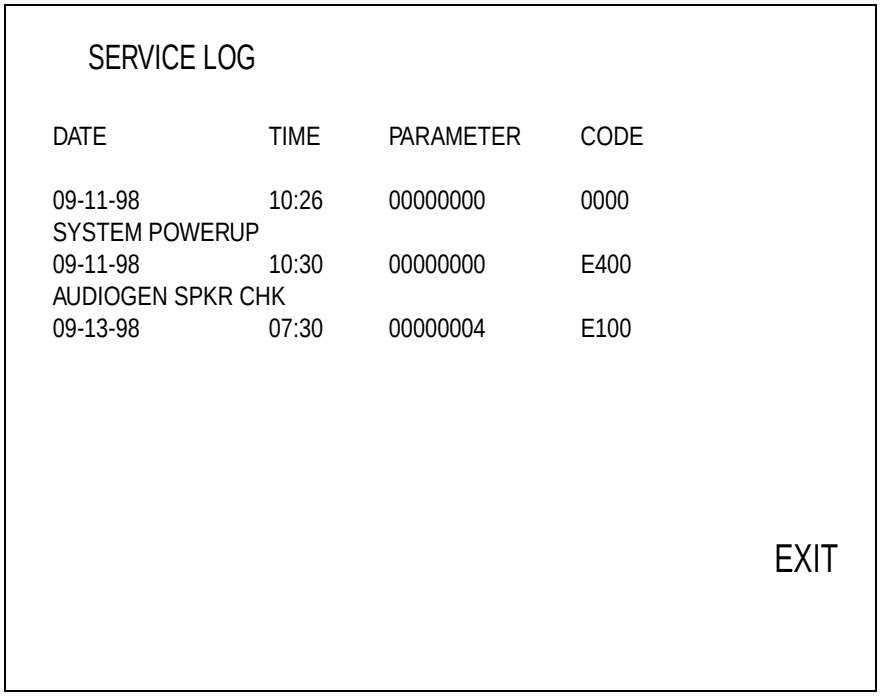


Figure 2-5. Service Log Screen

2.3 PMS Criteria Screen

The PMS Criteria Screen allows you to select the month when the PREVENTIVE MAINTENANCE DUE message appears on the power-up diagnostics screen.

From the Service Screen (described earlier), press the hidden key next to PMS SCHED.

Figure 2-6 shows an example of the screen that will appear. Use the ▲ and ▼ keys to set the desired month.

Press the key next to EXIT to return to the Main Service Screen.

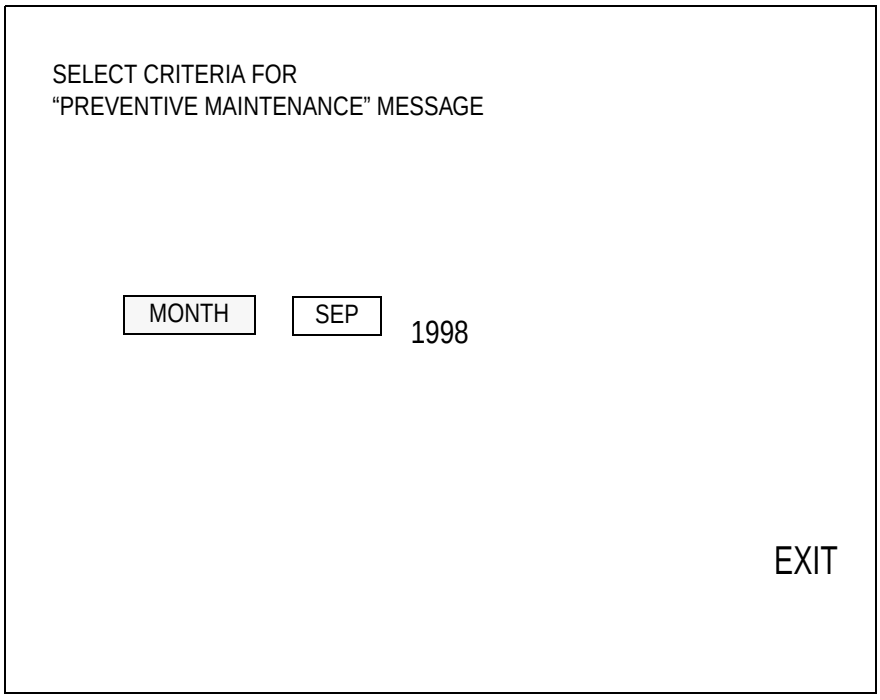


Figure 2-6. PMS Criteria Screen

2.4 Oxygen Monitor Service Screen

The Oxygen Monitor Service Screen shown in Figure 2-7 displays current readings for the O_2 cells, a zero calibration procedure, and the stored calibration values.

From the Service Screen (described earlier), press the key next to MON CAL.

To perform a zero calibration, follow the calibration procedure shown on the screen. Pressing the key next to ZERO stores the current values as the new zero calibration.

To proceed to the Pressure Monitor Service Screen, press the key next to PRES MON. To return to the Main Service Screen, press the key next to EXIT.

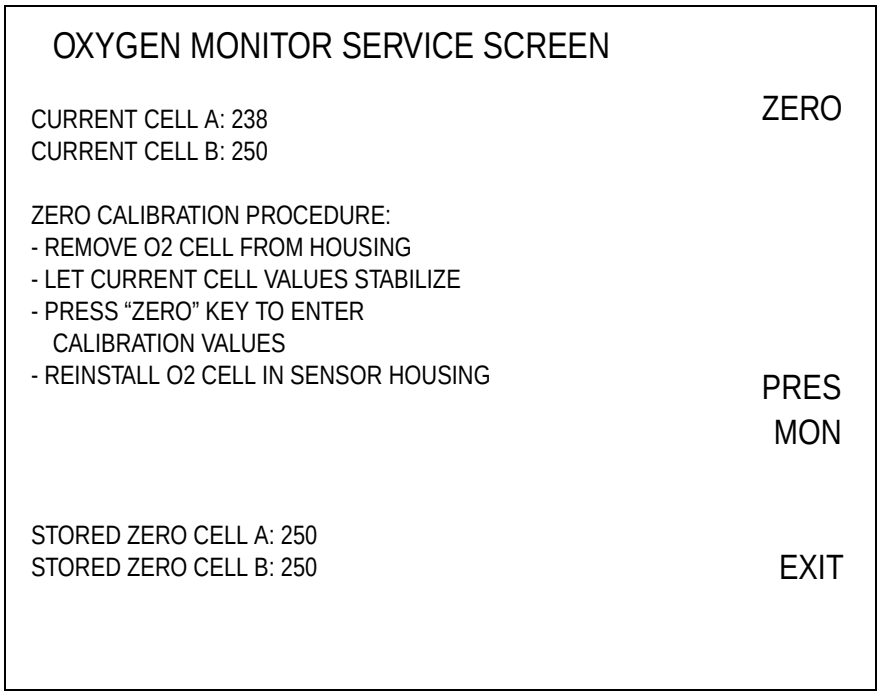


Figure 2-7. Oxygen Monitor Service Screen

2.5 Pressure Monitor Service Screen

The Pressure Monitor Service Screen shown in Figure 2-8 displays the current reading for airway pressure, a procedure for zero and span calibration, and the stored calibration values.

To enter the Pressure Monitor Service Screen from the Oxygen Monitor Service Screen (described earlier), press the key next to PRES MON (ref. Figure 2-7).

To perform a zero calibration, follow the procedure shown on the screen. Pressing the key next to ZERO stores the current value as the new zero calibration.

To perform a span calibration, follow the procedure shown on the screen. Pressing the key next to SPAN stores the current value as the new span calibration.

To return to the Oxygen Monitor Service Screen, press the key next to OXY MON. To return to the Main Service Screen, press the key next to EXIT.

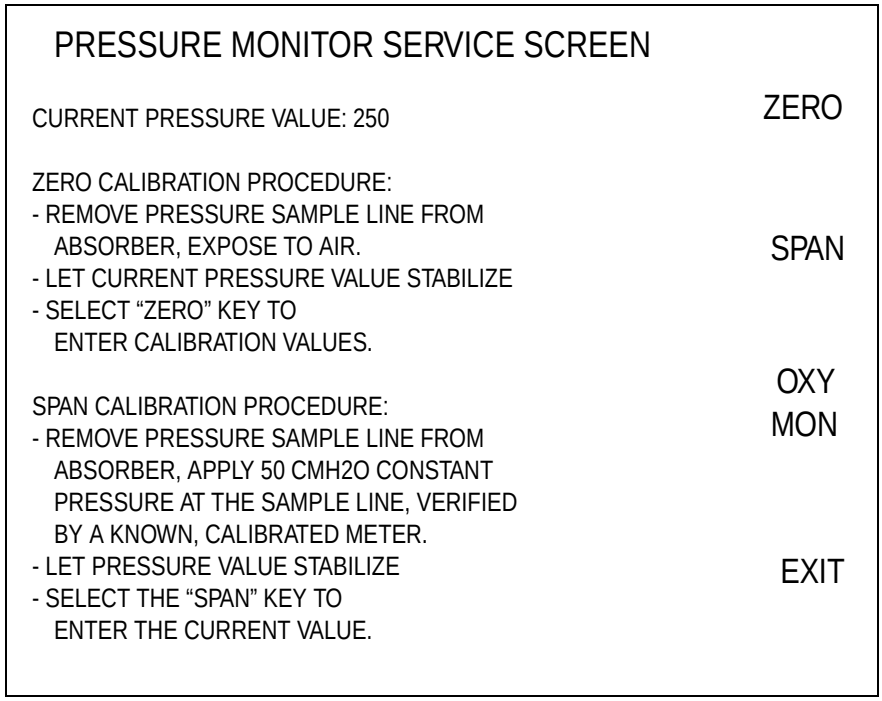


Figure 2-8. Pressure Monitor Service Screen

2.6 Serial Port Configuration Screen

The Serial Port Configuration screen shown in Figure 2-9 allows you to set the machine parameters for communicating with external devices.

From the Service Screen (described earlier), press the key next to PORT.

Use the ▼ and ▲ keys to change the settings; press the key next to SELECT to move to the next setting.

Press the key next to EXIT to return to the Main Service Screen.

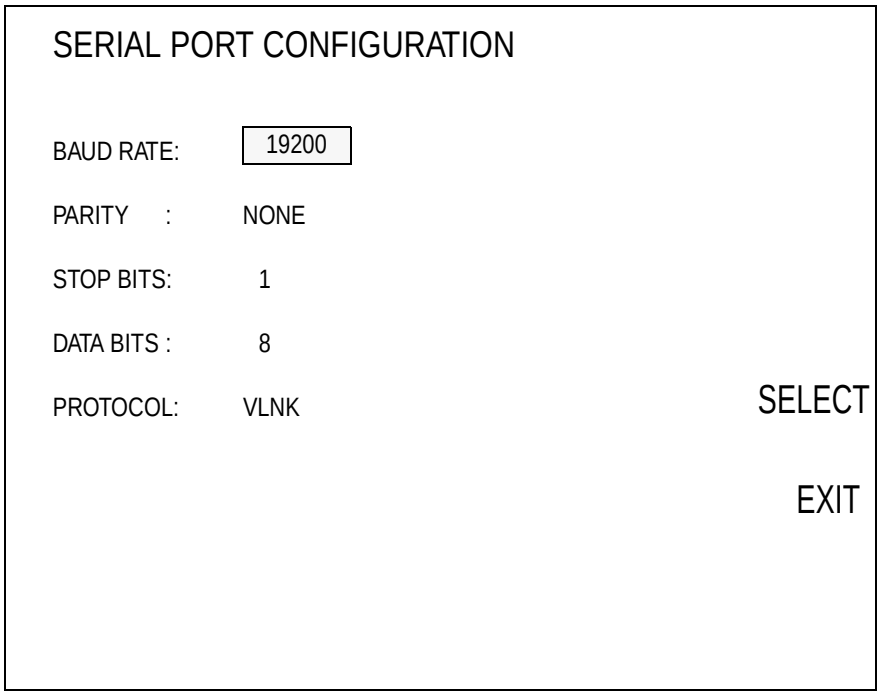


Figure 2-9. Serial Port Configuration Screen

3.0 Troubleshooting

This section contains information to assist the North American Dräger qualified Technical Service Representative (TSR) in locating electrical faults affecting the Narkomed Mobile monitoring and display devices. Since most troubleshooting efforts begin with verifying power supply voltages, the following paragraph outlines the voltage distribution scheme within the machine along with test points for each of the voltages.

3.1 Power Supply and Voltage Distribution

In the Narkomed Mobile, +5VDC, +12VDC and -12VDC are supplied to J14 on the processor board; +8VDC is supplied to J2 on the ventilator controller. These voltages can be measured at the connectors shown in Figure 3-1. Output voltage of the primary power supply is measured at J3 on the Condor supply. Table 3-1 lists the acceptable range for each voltage under normal load conditions. Figure 3-2 shows a block diagram of the Narkomed Mobile voltage distribution scheme.

Table 3-1. Test Points and Allowable Ranges

PROCESSOR	VOLTAGE	ACCEPTABLE RANGE
J14-12,14 (Red, Orn)	+ 5 VDC	4.80 to 5.25 VDC
J14-1 (Wht)	+ 12 VDC	11.65 to 12.85 VDC
J14-5 (Gry)	- 12 VDC	-11.50 to -13.00 VDC
J14-7,8,9 (Grn, Blu, Yel)	Common	
VENTILATOR CONTROLLER	**VOLTAGE**	**ACCEPTABLE RANGE**
J2-3 (Brn)	+ 8 VDC	7.70 to 8.30 VDC
J2-1 (Yel)	Common	
CONDOR PWR SUPP	**VOLTAGE**	**ACCEPTABLE RANGE**
J3-1 (Brn)	+ 15 VDC	14.0 to 16.0 VDC
J3-8 (Wht)	Common	

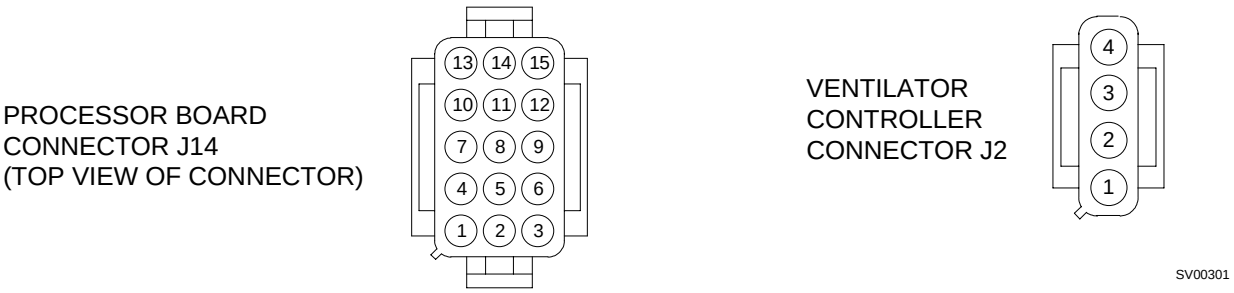


Figure 3-1. Power Supply Voltage Test Points

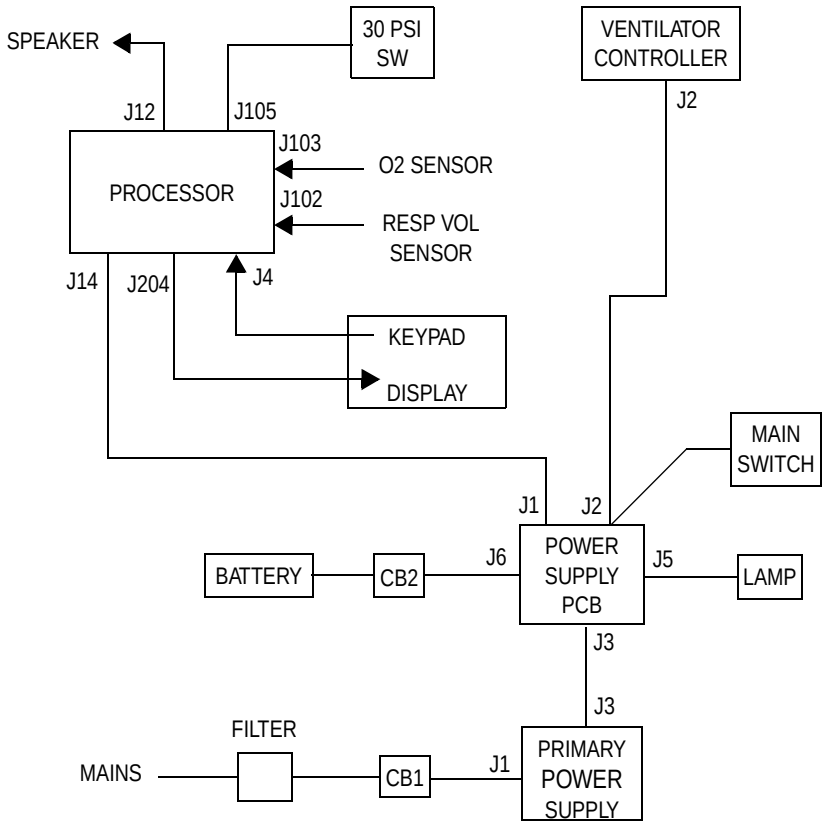


Figure 3-2. Narkomed Mobile Power Distribution

NOTE: The Narkomed Mobile will not turn on, or operate, unless the power cable is connected to J14 on the processor board. Disconnecting this cable breaks a sense connection that automatically powers down +5V, +12V, -12V, and +8V.

3.2 Battery

While the machine is operating from an AC line, the battery voltage at full charge should be within the range of 13.50 to 14.80 VDC. Battery voltage can be measured at the battery terminals. During battery operation, the low battery cutoff voltage should be within the range of 10.5 to 10.0 VDC.

3.3 Troubleshooting Guides

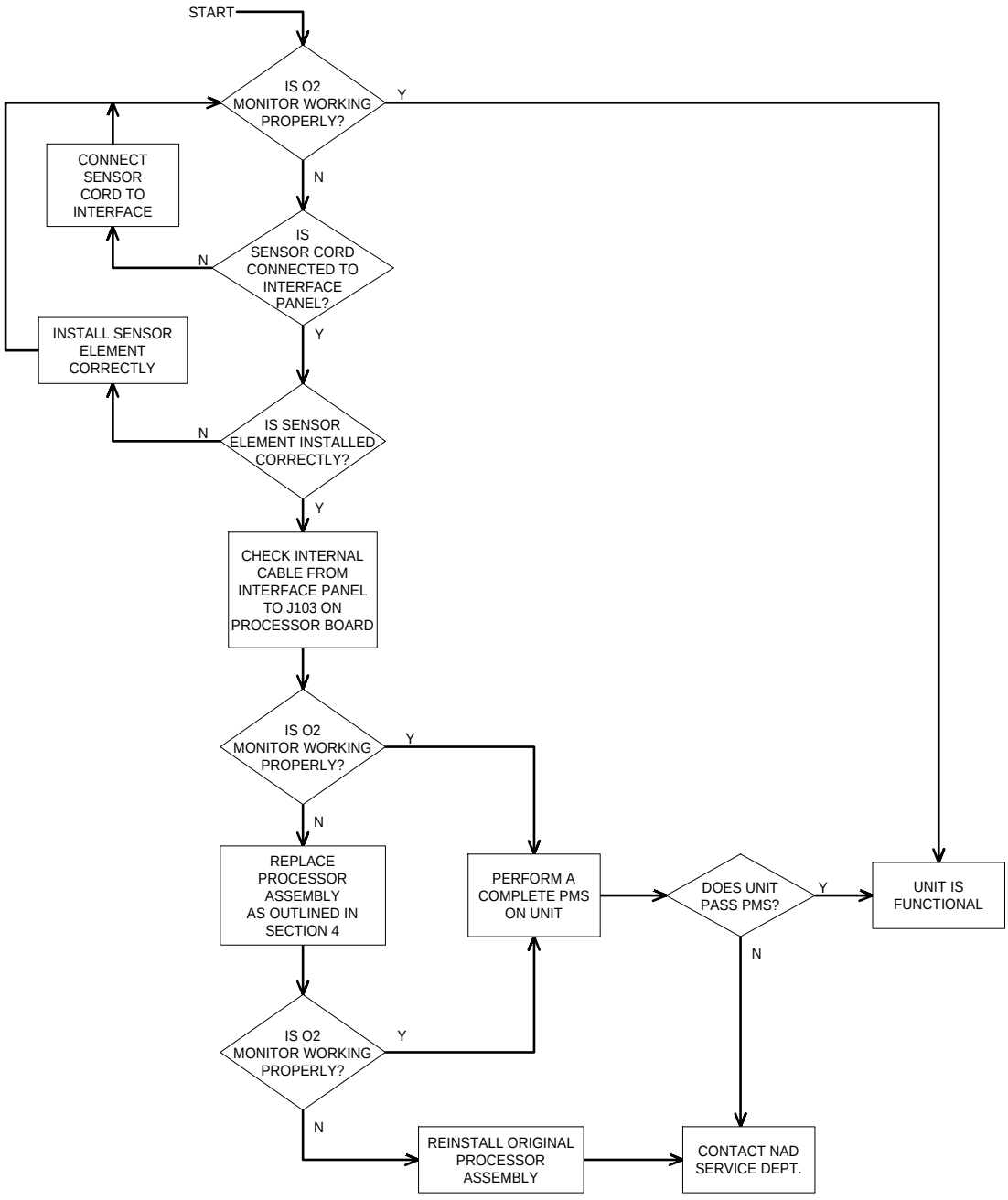
Table 3-2 lists common failure modes and symptoms (excluding simultaneous multiple faults) for the monitoring and display devices in the Narkomed Mobile. Each failure mode or symptom is keyed to a troubleshooting guide flow chart at the back of this section to assist the TSR in locating a problem. These flow charts assume that the machine is plugged into an AC outlet with the correct voltage, and the machine is not running on its backup battery.

Table 3-2. Narkomed Mobile Failure Mode and Symptom List

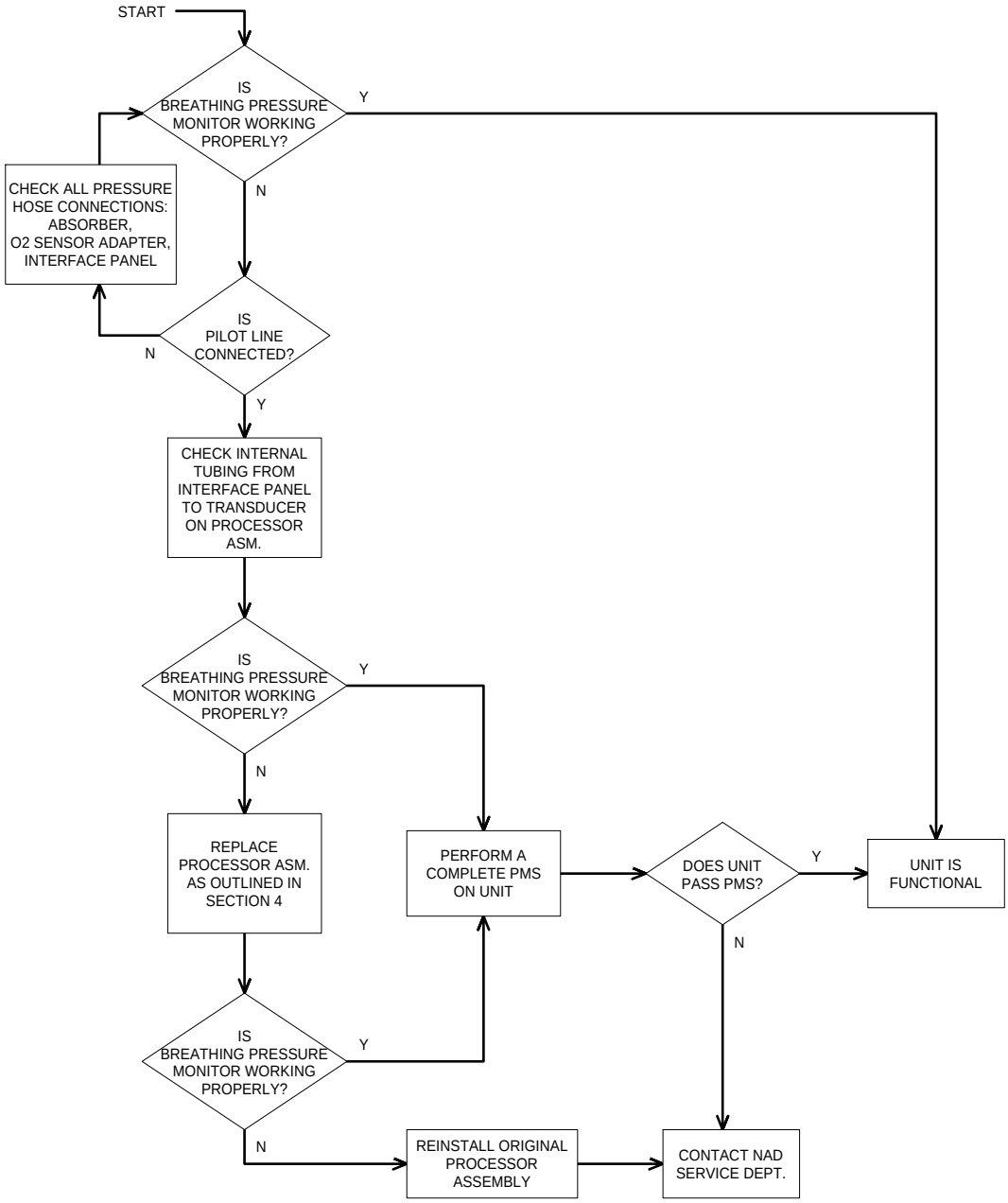
FAILURE MODE / SYMPTOM	CORRECTIVE ACTION
Loss of O_2 Monitor	Guide 1
Loss of Breathing Pressure Monitor	Guide 2
Loss of Respiratory Volume Monitor	Guide 3
No Audio Alarms	Guide 4
Serial Port Communication Failure	Guide 5
No Oxygen Supply Pressure Alarms	Guide 6
Display Blank Upon System Power-up	Guide 7
Keypad Inoperative	Guide 8
Ventilator Inoperative	Guide 9

TROUBLESHOOTING GUIDE (continued)

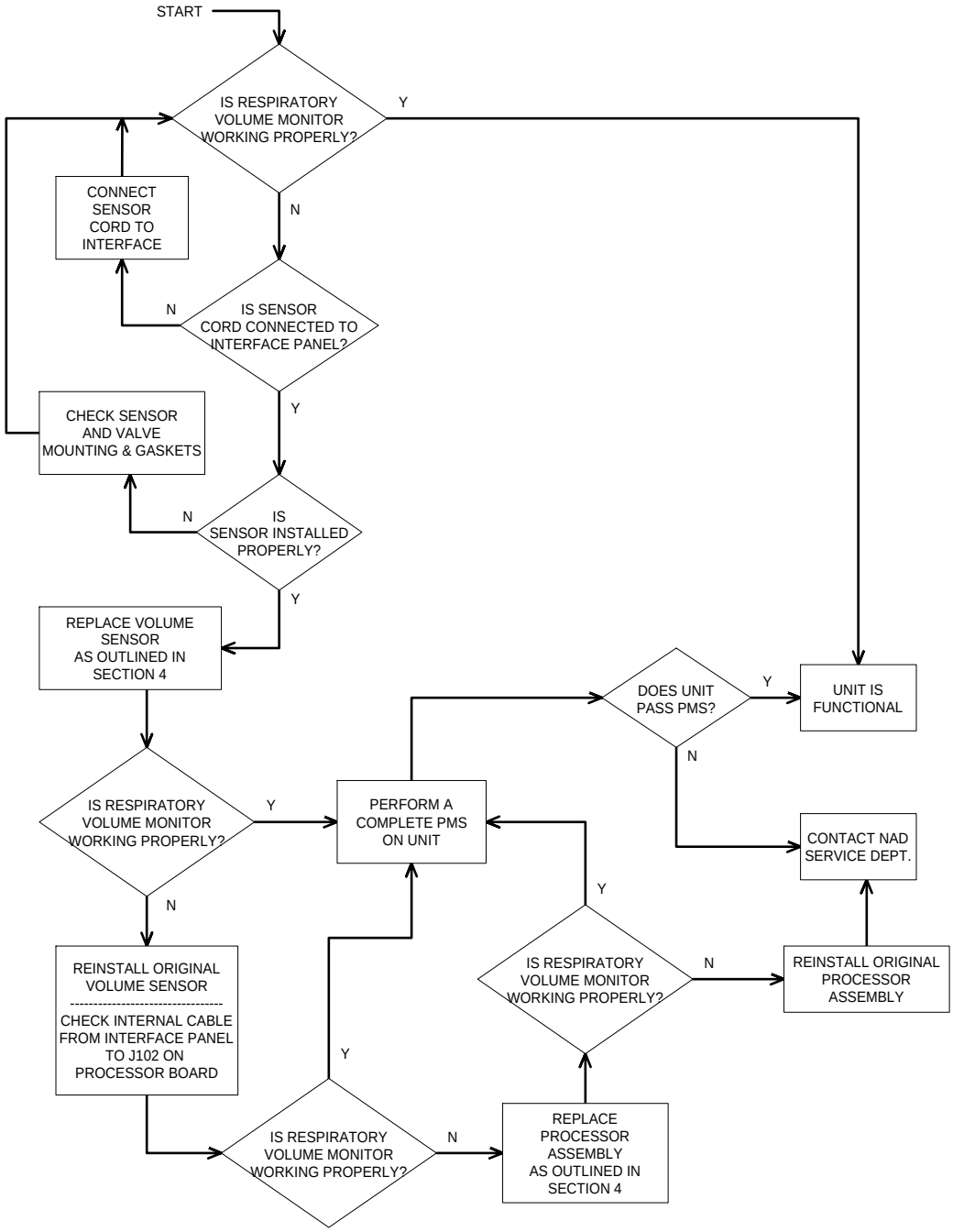
GUIDE 1: Loss of O_2 Monitor



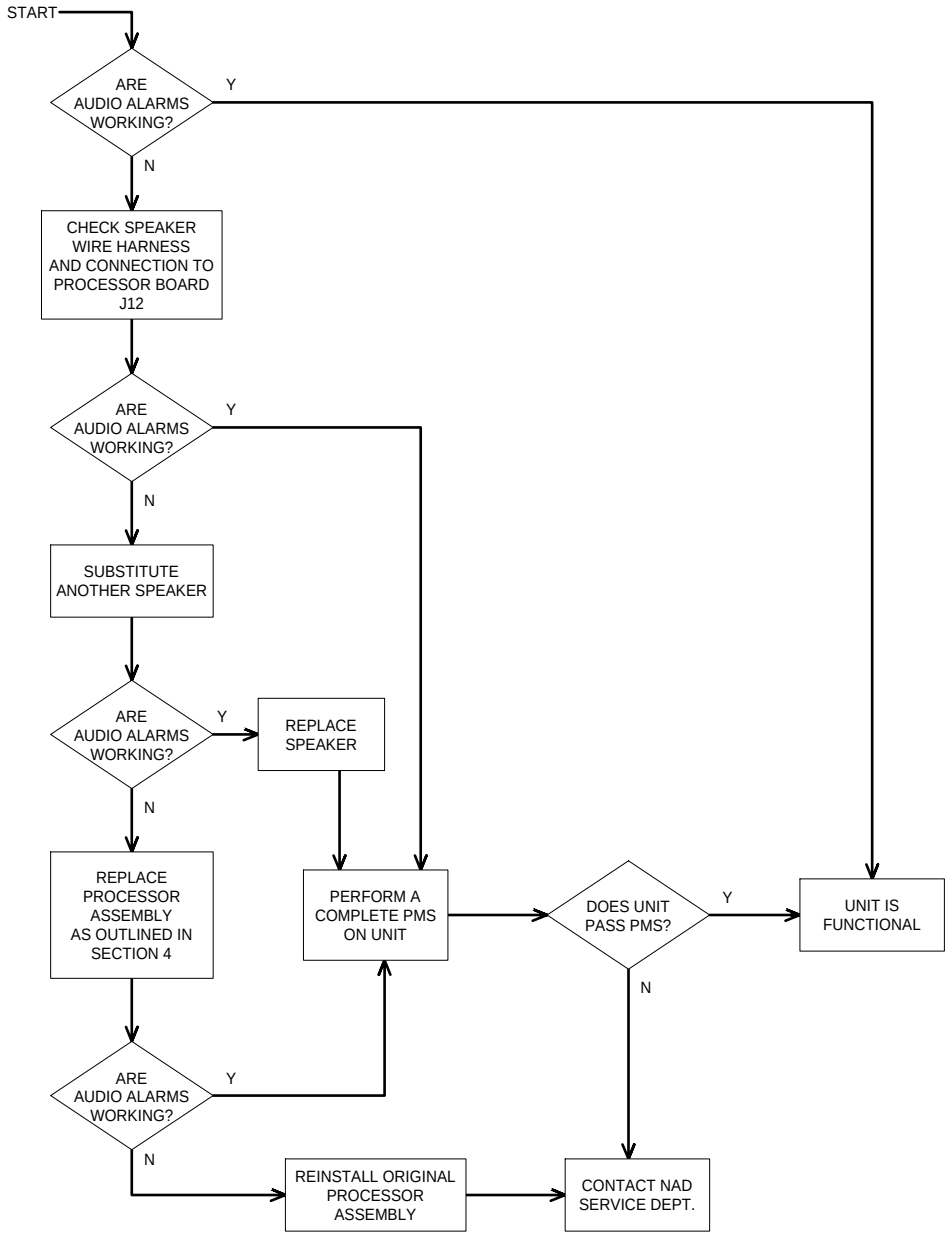
GUIDE 2: Loss of Breathing Pressure Monitor



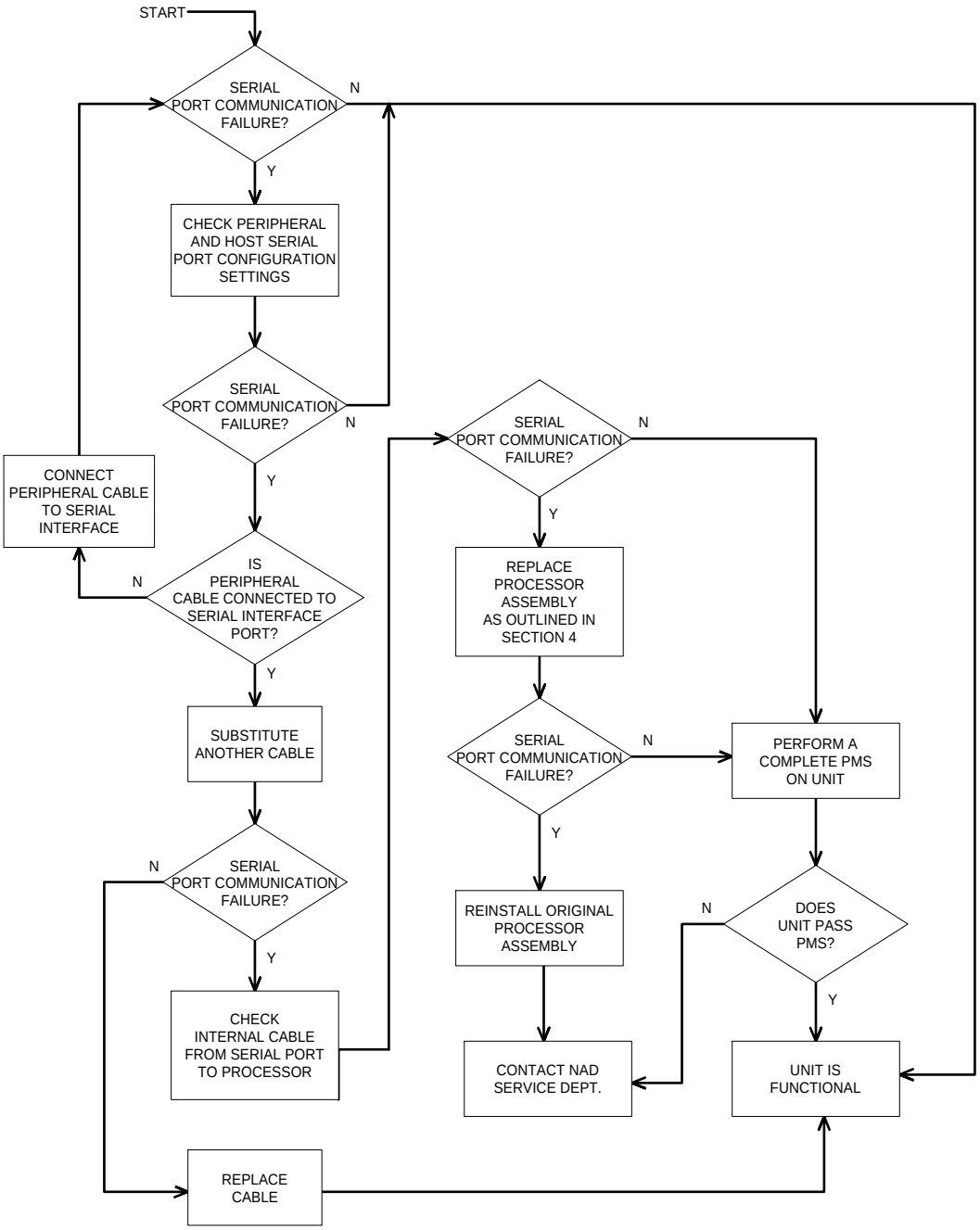
GUIDE 3: Loss of Respiratory Volume Monitor



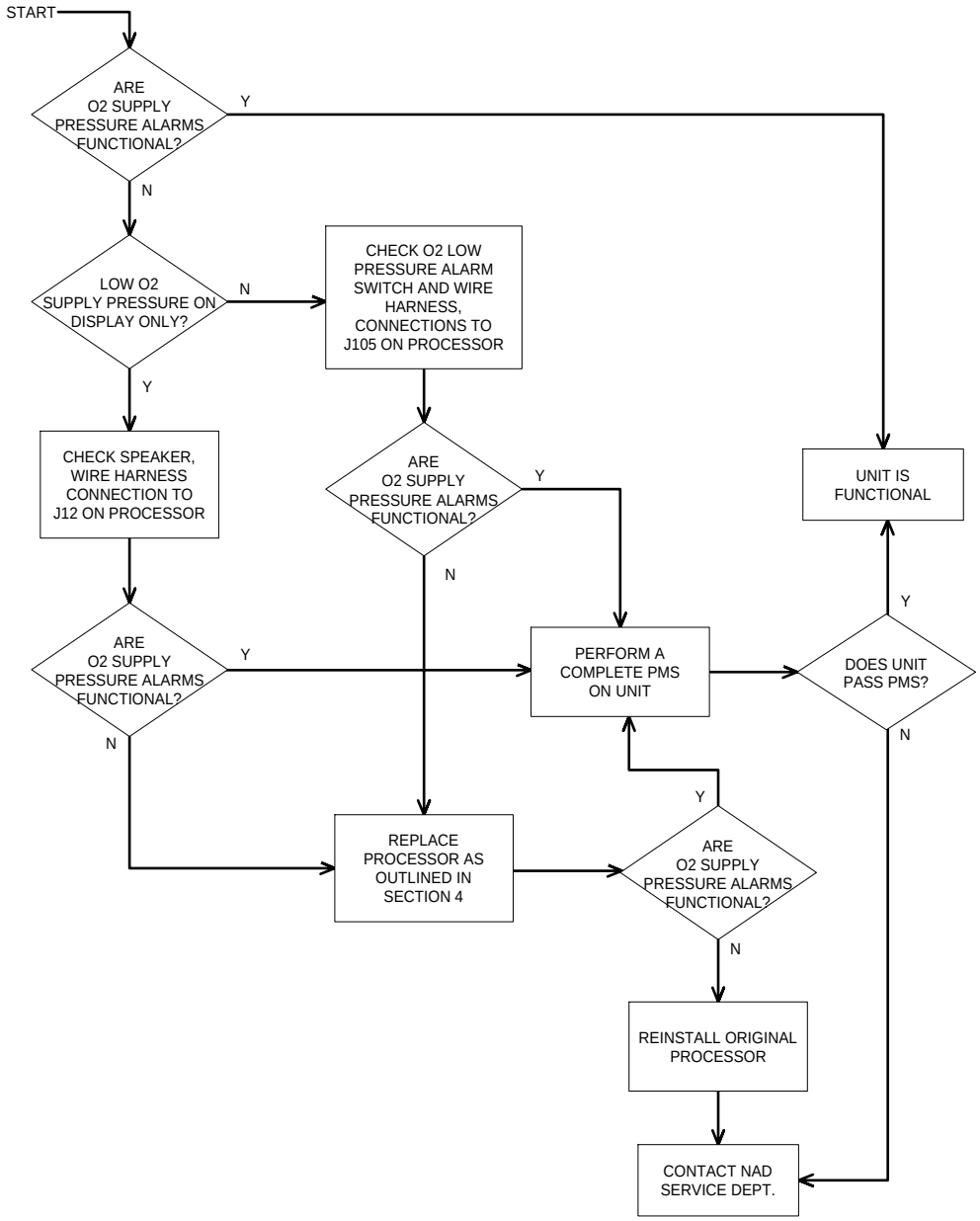
GUIDE 4: No Audio Alarms



GUIDE 5: Serial Port Communication Failure

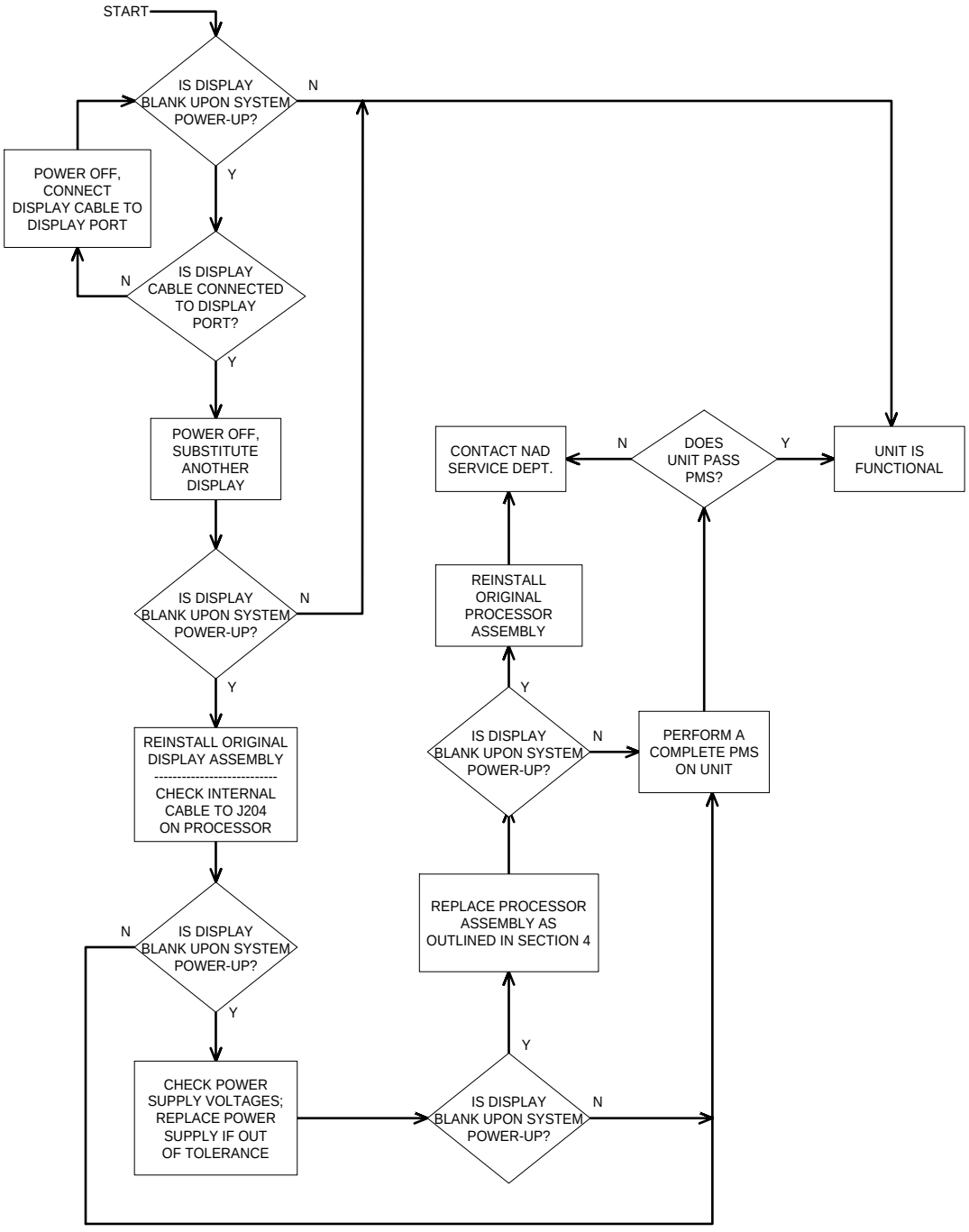


GUIDE 6: No O_2 Supply Pressure Alarms

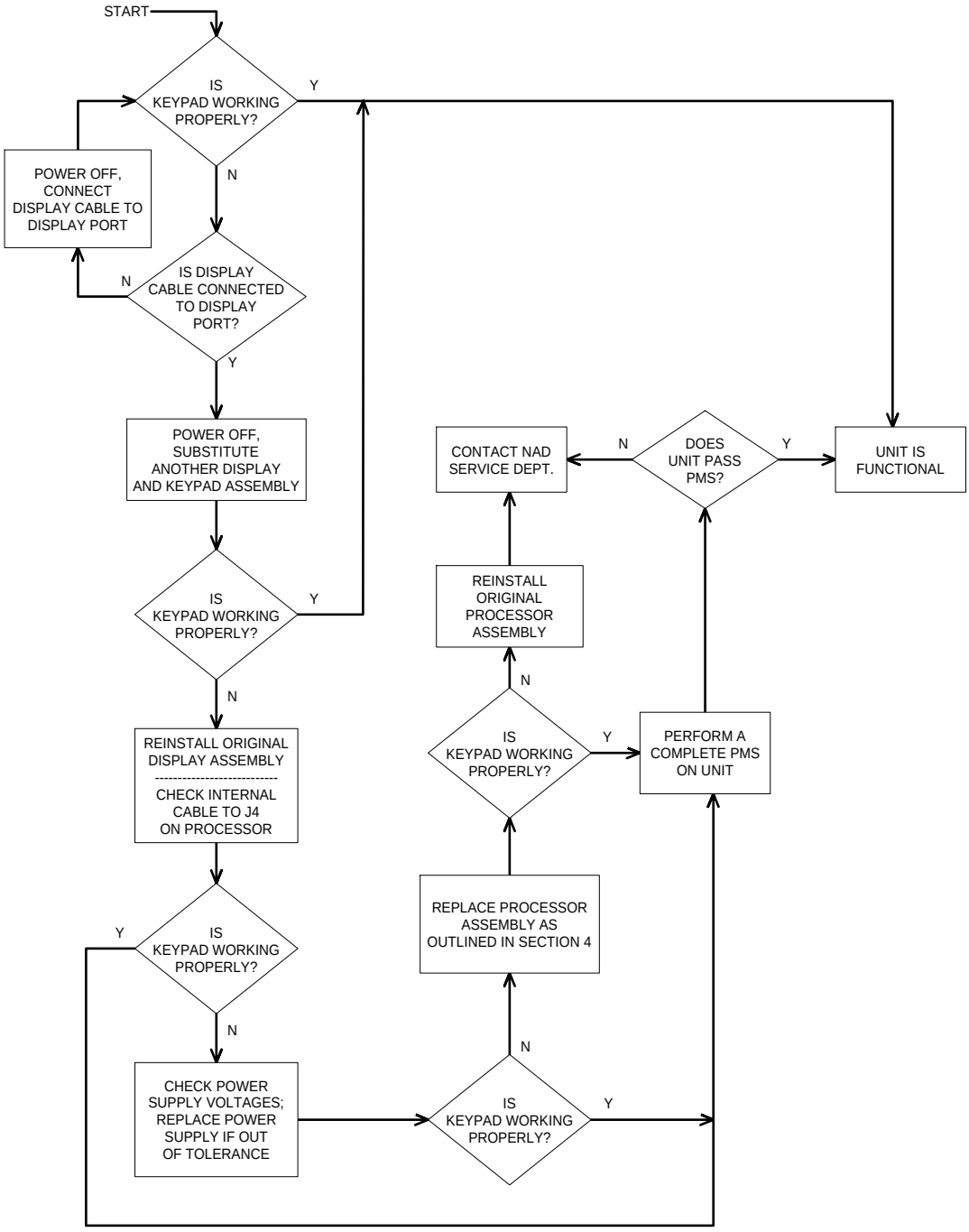


TROUBLESHOOTING GUIDE (continued)

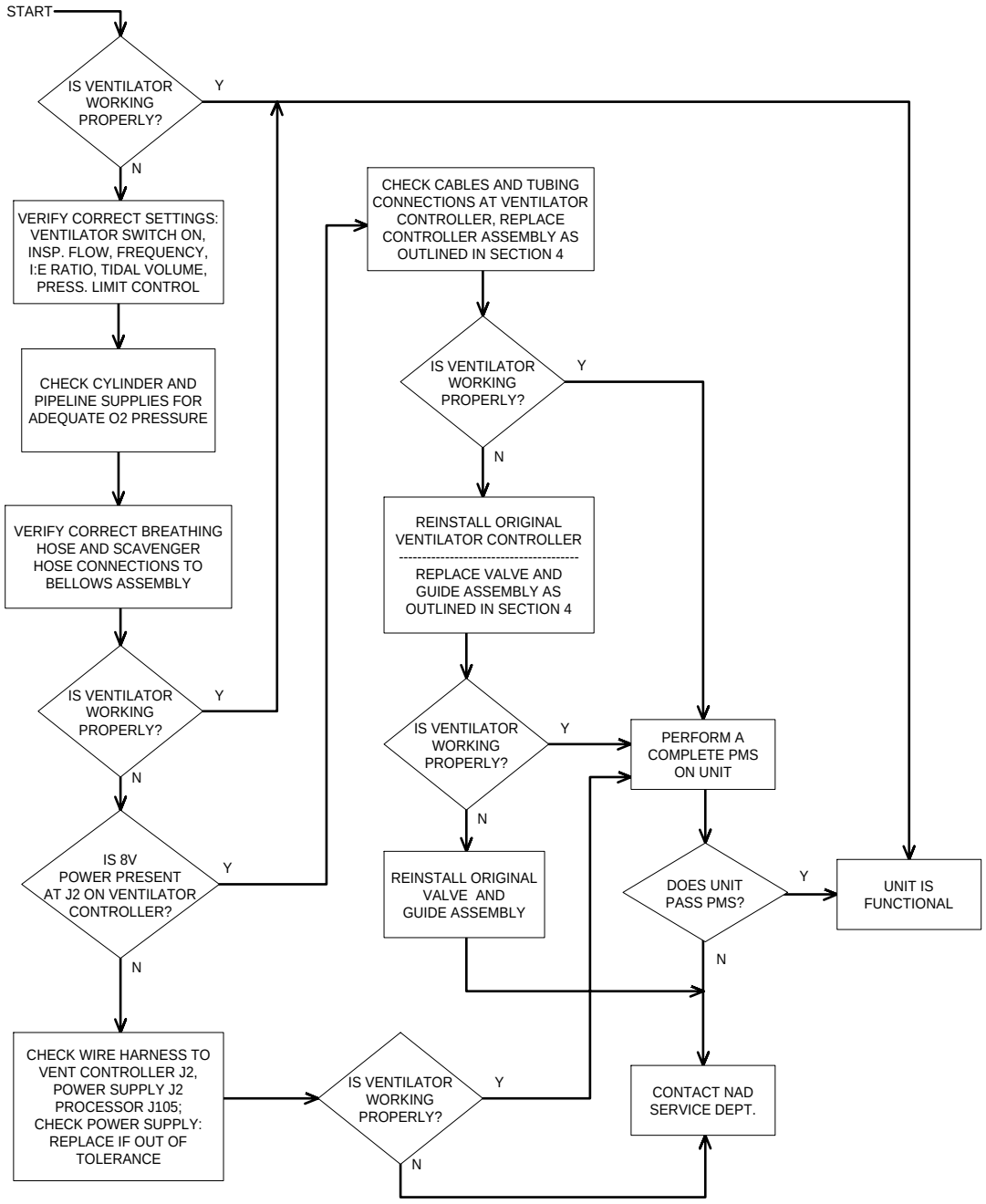
GUIDE 7: Display Blank Upon System Power-up



GUIDE 8: Keypad Inoperative



GUIDE 9: Ventilator Inoperative



4.0 Replacement Procedures

This section outlines removal and replacement procedures for the field-replaceable assemblies of the Narkomed Anesthesia System.

These procedures are to be performed only by a North American Dräger qualified Technical Service Representative (TSR).

The following are the only procedures authorized by North American Dräger to be performed in the field. All other service procedures shall be referred to NAD's Technical Service Department.

NOTE: The PMS PROCEDURE given in Section 6 must be performed after any replacement, removal, calibration or adjustment procedure.

4.1 Cylinder Yokes and Regulators

The cylinder yokes and regulators are installed as an assembly consisting of the yoke, check valve, regulator and spacer block. Access to the tubing connections requires removal of the flowmeter housing back cover. Tubing and mounting arrangements are shown in Figure 4-1.

4.1.1 Disconnect all pipeline hoses and turn the System Power switch to ON.

4.1.2 Close the N_2O cylinder valve; open the oxygen cylinder valve.

4.1.3 Set the oxygen flow to 5 liters per min.

4.1.4 Open the other gas flow control valves to drain pressure from the system.

4.1.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.1.6 Turn the System Power switch to STANDBY.

4.1.7 Remove the cylinders from the yokes.

4.1.8 Remove the flowmeter housing back cover.

4.1.9 Disconnect the tubing from the regulators where connections are accessible.

For regulator connections that are not accessible, disconnect these tubes at their other end.

4.1.10 Remove the yoke spacer mounting screws, and lift the assembly from the flowmeter housing.

4.1.11 If you are replacing a regulator, record the serial number of the regulator that was removed, and record the serial number of the replacement regulator.

4.1.12 Where tubing was removed, transfer the tubing to the corresponding connections on the replacement regulator.

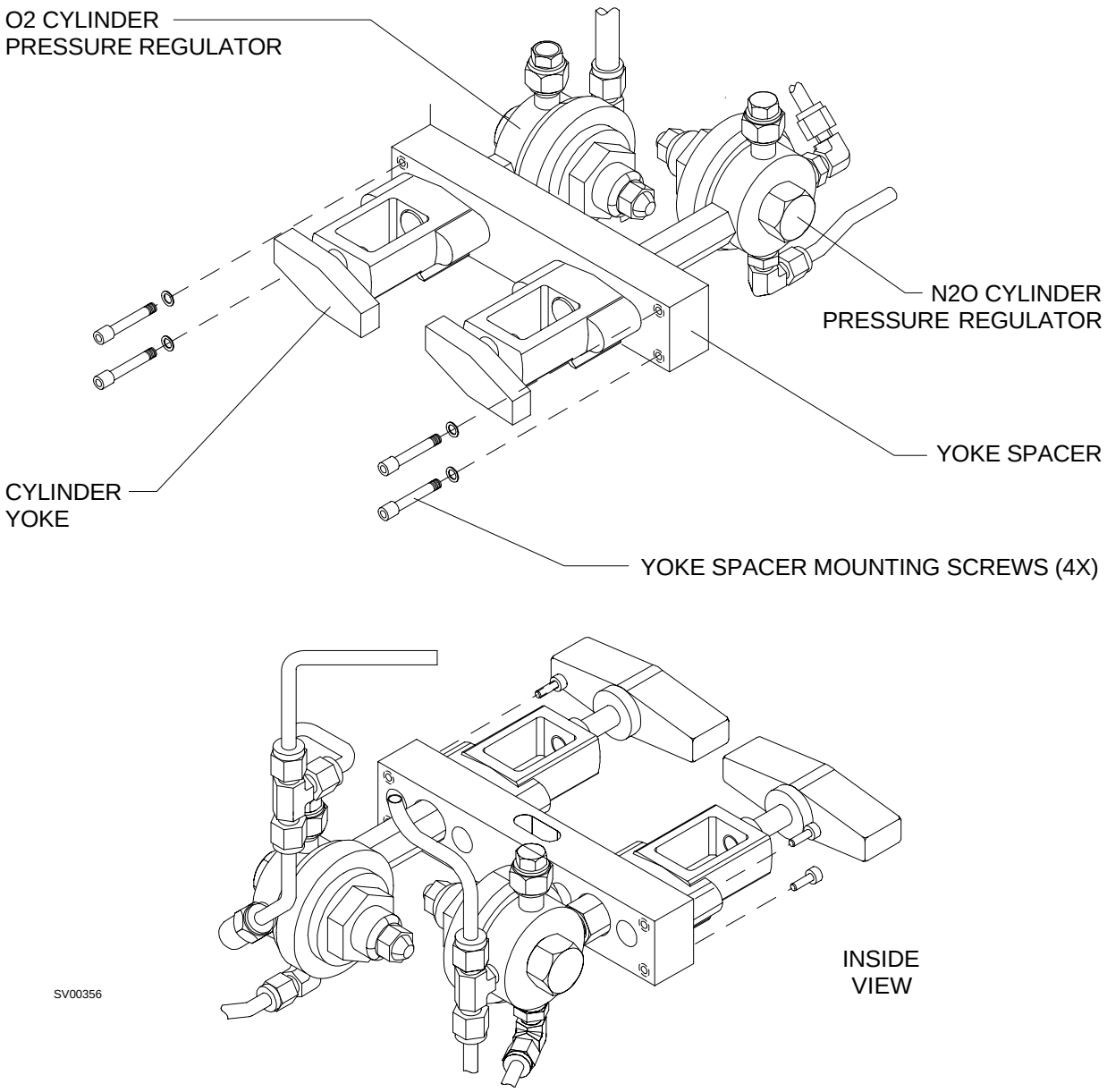


Figure 4-1. Cylinder Yokes and Regulators

4.1.13 Position the replacement yoke and regulator assembly in the flowmeter housing, and secure it with the hardware that was previously removed.

4.1.14 Reconnect all tubing that was previously disconnected within the flowmeter housing.

4.1.15 Reinstall the cylinders in the yokes.

4.1.16 Measure (and adjust if necessary) the regulator output pressure in accordance with the procedure given in Section 5.

4.1.17 Reinstall the flowmeter housing back cover.

4.1.18 Perform the PMS Procedure given in Section 6.

4.2 Cylinder and Pipeline Pressure Gauges

Replacement of the cylinder and pipeline pressure gauges requires disassembly in the flowmeter sub-assembly area for access to the gauge connections. Figure 4-2 shows gauge mounting and connection details.

4.2.1 Disconnect all pipeline hoses and turn the System Power switch to ON.

4.2.2 Open the oxygen cylinder valve.

4.2.3 Set the oxygen flow to 5 liters per min.

4.2.4 Open the other gas flow control valves to drain pressure from the system.

4.2.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.2.6 Turn the System Power switch to STANDBY.

4.2.7 Remove the oxygen flow control knob.

4.2.8 Remove the two screws holding the knob guard in place, and remove the knob guard.

4.2.9 Remove the plexiglass flowmeter shield.

4.2.10 Remove the flowmeter housing back cover. Be sure to disconnect the ventilator exhaust hose.

4.2.11 Disconnect the copper tubing at points **A**, **B**, **C** and **D** as shown in Figure 4-2A.

4.2.12 Remove the four screws securing the flowmeter sub-assembly to the flowmeter housing.

4.2.13 Pull the flowmeter sub-assembly forward far enough to gain access to the gauge connections.

4.2.14 For the cylinder pressure gauges:

Disconnect the 3/16 in. copper tube compression fitting at the back of the gauge.

For the pipeline pressure gauges:

Remove the press-on hose clamp and disconnect the flex tubing from the hose barb at the back of the gauge.

REPLACEMENT PROCEDURES (continued)

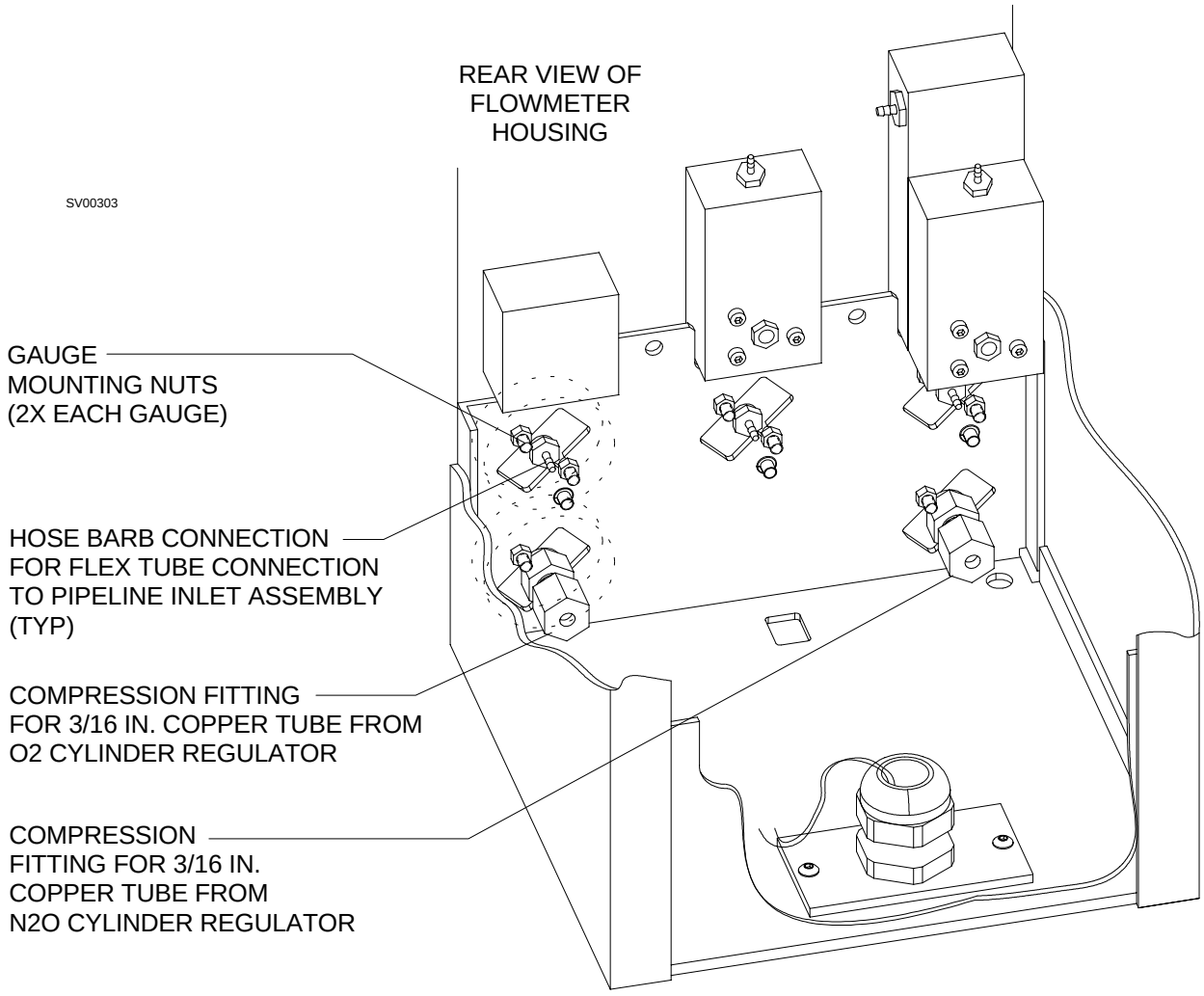


Figure 4-2. Cylinder and Pipeline Pressure Gauges

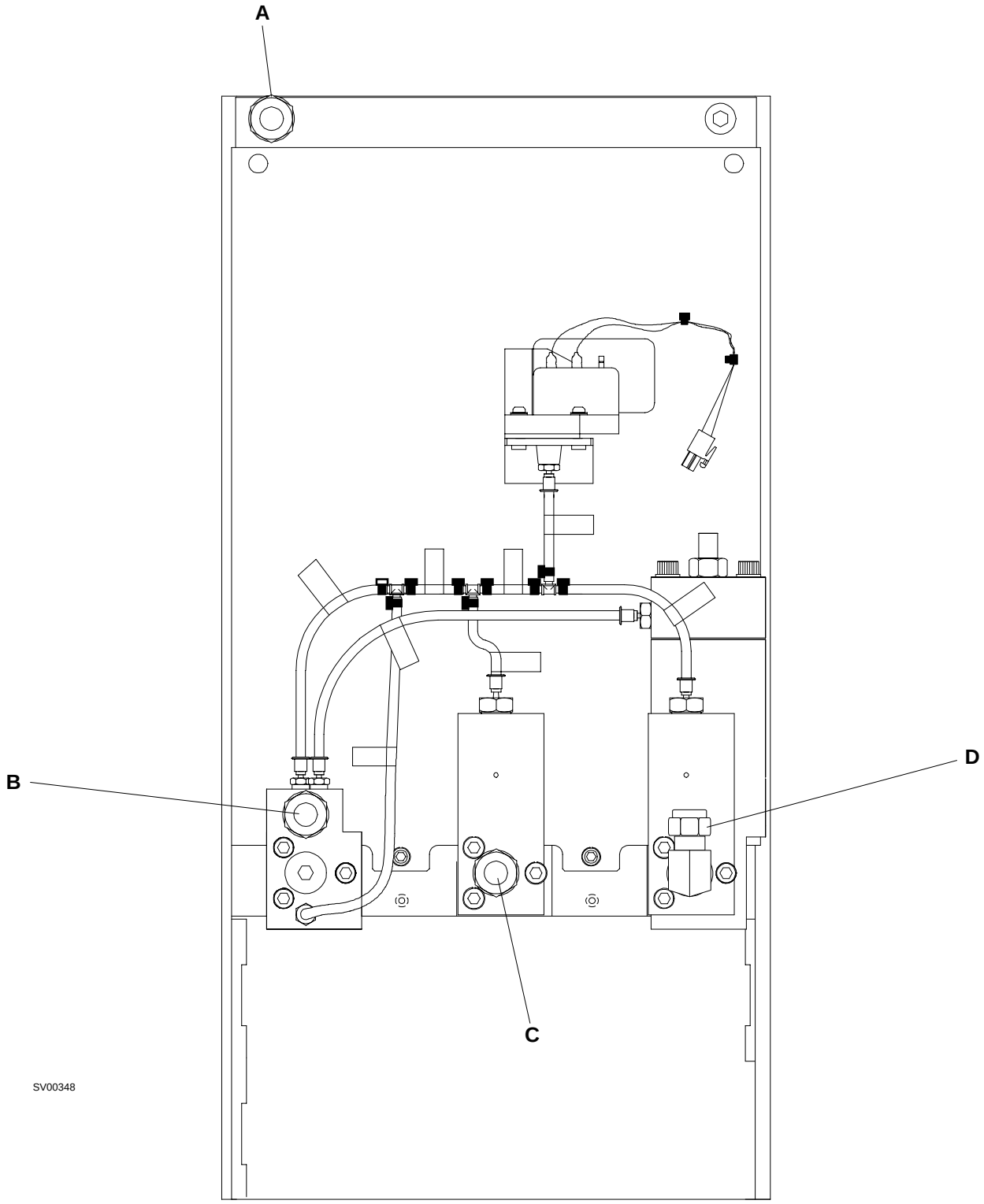


Figure 4-2A. Tubing Connections: Flowmeter Sub-assembly

4.2.15 Remove the gauge mounting nuts, and remove the gauge from the front of the flowmeter housing.

4.2.16 Install the replacement gauge in the flowmeter housing and secure it with the hardware that was previously removed.

4.2.17 For the cylinder pressure gauges:

Reconnect the 3/16 in. copper tube compression fitting at the back of the gauge.

For the pipeline pressure gauges:

Reconnect the flex tubing from to the hose barb at the back of the gauge, and secure it with the press-on hose clamp.

4.2.18 Reinstall the flowmeter sub-assembly, and reconnect all copper tubing.

4.2.19 Reinstall the front plexiglass flowmeter shield.

4.2.20 Reinstall the knob guard and secure it with the two mounting screws.

4.2.21 Reinstall the oxygen flow control knob. Re-set the 'off stop' with the label oriented correctly.

4.2.22 Reconnect the ventilator exhaust hose and reinstall the flowmeter housing back cover.

4.2.23 Connect the pipeline supplies.

4.2.24 Perform the PMS Procedure given in Section 6.

4.3 Flowmeters

The flowmeter tubes are held by compression in gaskets at the top and bottom of each tube. Each upper gasket is seated in an adjustable retainer that allows removal of the tube as shown in Figure 4-3. Access to the flow tubes and their retainers requires removal of the plexiglass flowmeter shield.

4.3.1 Disconnect all pipeline hoses and turn the System Power switch to ON.

4.3.2 Open the oxygen cylinder valve.

4.3.3 Set the oxygen flow to 5 liters per min.

4.3.4 Open the other gas flow control valves to drain pressure from the system.

4.3.5 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.3.6 Turn the System Power switch to STANDBY.

4.3.7 Remove the oxygen flow control knob.

4.3.8 Remove the two screws holding the knob guard in place, and remove the knob guard.

4.3.9 Remove the plexiglass flowmeter shield.

4.3.10 Turn the flow tube retainer as shown in the illustration until you can pull the top of the flow tube outward, and remove the tube.

NOTE: If the bottom of the tube is seated in a restrictor housing, be sure that the arrangement of the restrictor and its gaskets is not disturbed.

4.3.11 Make sure that the replacement flow tube bears the correct markings and has a ball.

CAUTION: The flow tube must be properly centered over the guide rings or damage to the flow tube may occur.

4.3.12 Place the bottom of the flow tube into the guide ring of the lower gasket, and position the top of the flow tube in the center of the retainer.

CAUTION: Do not over-tighten the retainer. Over-tightening the retainer may break the flowmeter tube.

REPLACEMENT PROCEDURES (continued)

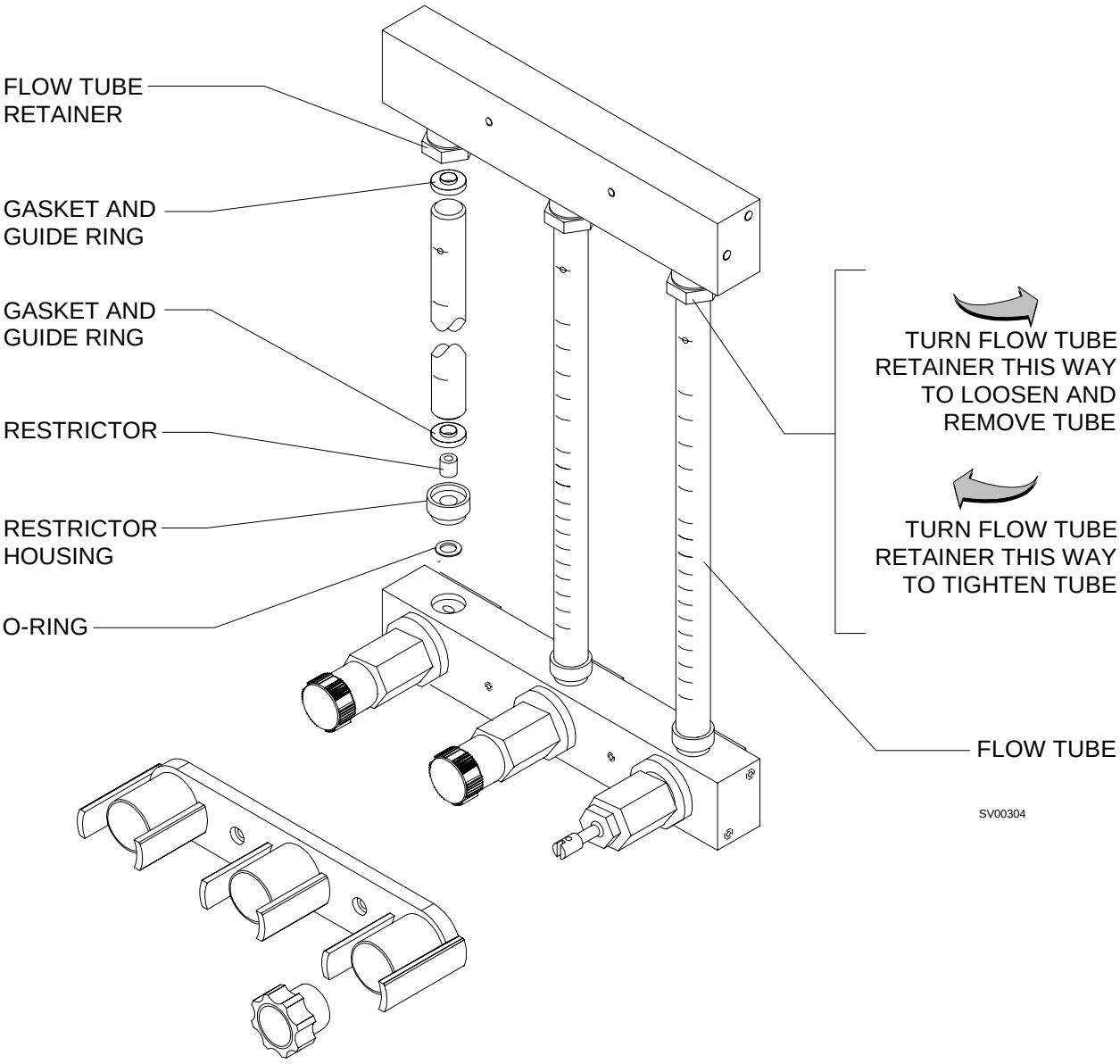


Figure 4-3. Flow Tube Replacement

4.3.13 Ensure that the markings on the flow tube are facing forward, and turn the retainer as shown in the illustration until the flow tube is firmly held in place.

4.3.14 Perform the following leak test on the system:

Disconnect the absorber hose from the fresh gas outlet. Ensure that all flow control valves are closed.

Connect a test gauge and B.P. bulb to the fresh gas outlet, and pressurize the system to 50 cm H_2O.

The pressure should not drop more than 10 cm H_2O in thirty seconds.

4.3.15 Disconnect the test gauge and re-connect the absorber hose to the fresh gas outlet.

4.3.16 Reinstall the front plexiglass flowmeter shield.

4.3.17 Reinstall the knob guard and secure it with the two mounting screws.

4.3.18 Reinstall the oxygen flow control knob.

4.3.19 Connect the pipeline hoses.

4.3.20 Perform the PMS Procedure given in Section 6.

4.4 Auxiliary O_2 Flowmeter

The auxiliary O_2 flowmeter is attached to the side of the flowmeter housing. Access to its attaching hardware requires disassembly in the flowmeter sub-assembly area. Figure 4-4 shows the arrangement of the mounting screws and O_2 supply line.

4.4.1 Disconnect all pipeline hoses and turn the System Power switch to ON.

4.4.2 Open the oxygen cylinder valve.

4.4.3 Set the oxygen flow to 5 liters per min.

4.4.4 Open the other gas flow control valves to drain pressure from the system.

4.4.5 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.4.6 Turn the System Power switch to STANDBY.

4.4.7 Remove the flowmeter housing back cover. Be sure to disconnect the ventilator exhaust hose.

4.4.8 Ref. Figure 4-2A: Disconnect the copper tubing at points **A**, **B**, **C** and **D**.

4.4.9 Remove the four screws securing the flowmeter sub-assembly to the flowmeter housing.

4.4.10 Pull the flowmeter sub-assembly forward far enough to gain access to the auxiliary O_2 flowmeter mounting screws.

4.4.11 Remove the press-on hose clamp and disconnect the flexible auxiliary O_2 supply line from the hose barb on the O_2 pipeline inlet assembly.

4.4.12 Remove the screws securing the auxiliary O_2 flowmeter to the side of the flowmeter housing, and remove the flowmeter.

4.4.13 Position the replacement flowmeter at the side of the flowmeter housing (feed the flex tubing through the clearance hole) and secure the flowmeter with the two screws that were previously removed.

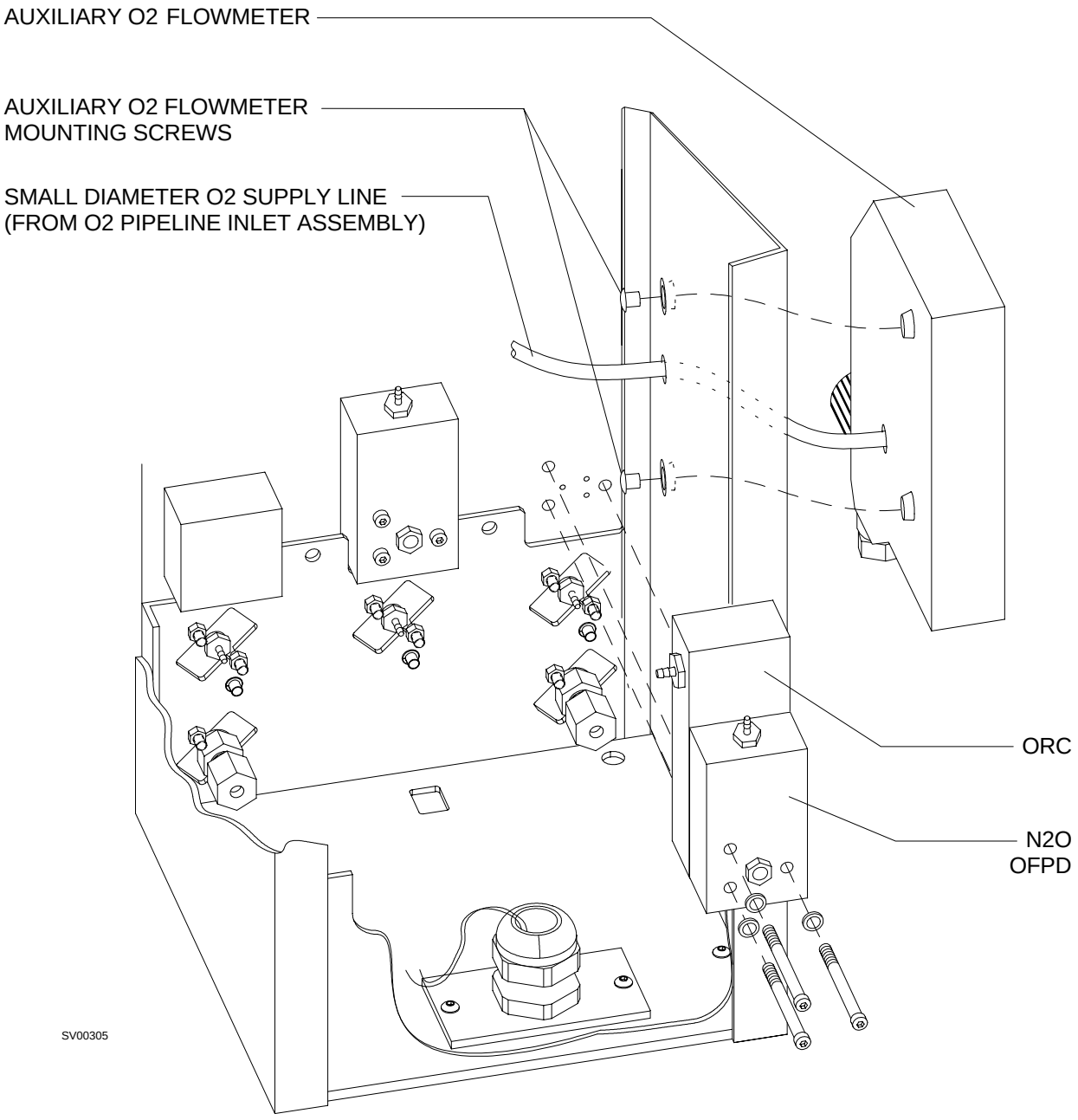


Figure 4-4. Auxiliary O2 Flowmeter

4.4.14 Reconnect the small diameter tubing from the auxiliary O_2 flowmeter to the hose barb on the O_2 pipeline inlet assembly and secure the connection with the press-on hose clamp.

4.4.15 Reinstall the flowmeter sub-assembly, and reconnect all copper tubing.

4.4.16 Reinstall the front plexiglass flowmeter shield.

4.4.17 Reinstall the knob guard and secure it with the two mounting screws.

4.4.18 Reinstall the oxygen flow control knob. Re-set the 'off stop' with the label oriented correctly.

4.4.19 Reconnect the ventilator exhaust hose and reinstall the flowmeter housing back cover.

4.4.20 Connect the pipeline supplies.

4.4.21 Perform the PMS Procedure given in Section 6.

4.5 Flow Control Valves

The flow control valves have replaceable elements that are removable from the front of the flowmeter sub-assembly as shown in Figure 4-5. Each flow control knob has a positive stop arrangement that prevents damage to the valve seat. Whenever a valve is replaced the "off stop" must be set as outlined in the following procedure.

4.5.1 Disconnect all pipeline hoses and turn the System Power switch to ON.

4.5.2 Open the oxygen cylinder valve.

4.5.3 Set the oxygen flow to 5 liters per min.

4.5.4 Open the other gas flow control valves to drain pressure from the system.

4.5.5 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.5.6 Turn the System Power switch to STANDBY.

4.5.7 Remove the oxygen flow control knob.

4.5.8 Remove the two screws holding the knob guard in place, and remove the knob guard.

4.5.9 Remove the plexiglass flowmeter shield.

4.5.10 Remove the knob (if not already removed) from the valve that is being replaced, and remove the stop pin nut.

4.5.11 Remove the flow control valve by holding it at the wrench flats and turning it counter-clockwise.

4.5.12 Install the replacement flow control valve in the flowmeter sub-assembly.

4.5.13 Reinstall the stop pin nut.

4.5.14 Reinstall the front plexiglass flowmeter shield.

4.5.15 Reinstall the knob guard and secure it with the two mounting screws.

4.5.16 Connect the pipeline supplies and turn the System Power switch to ON.

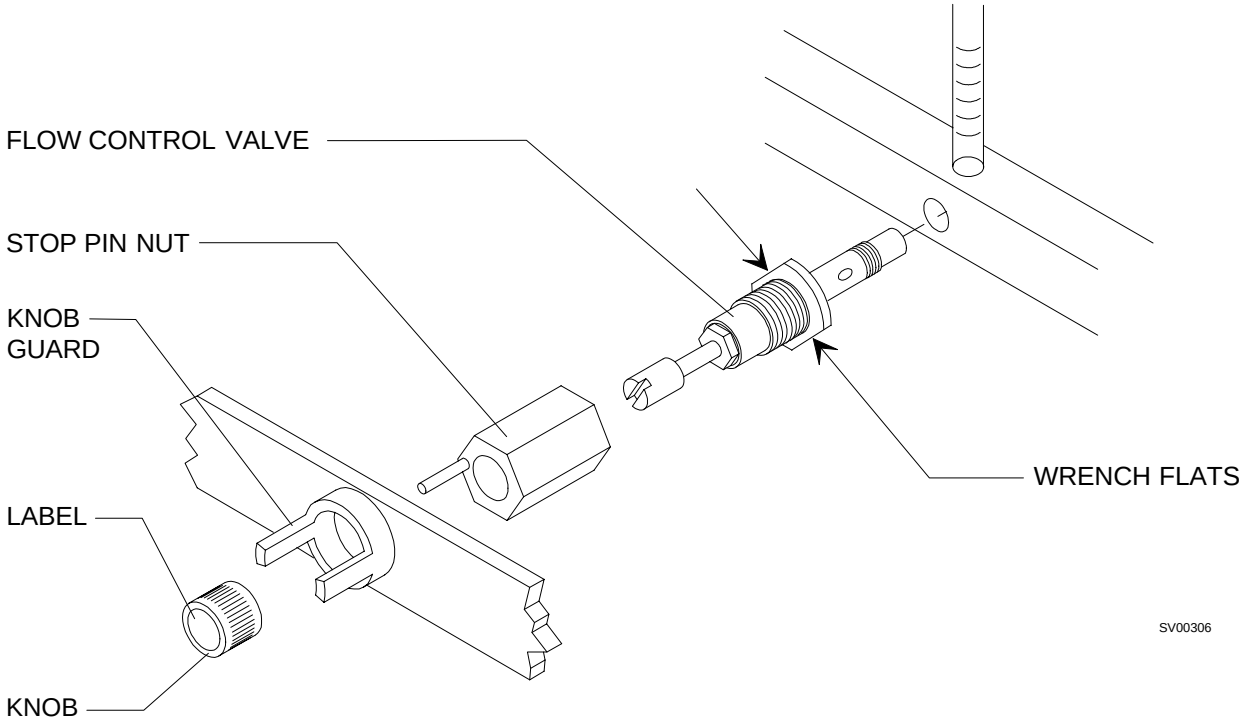


Figure 4-5. Flow Control Valves

4.5.17 For the O_2 flow control valve:

Turn the flow control valve clockwise until the flow rate will not drop any further. (If the machine has been modified to eliminate the minimum flow feature, turn the valve until the flow rate is zero.)

For the other gas flow control valves:

Set the oxygen flow rate to four liters per minute.

Turn the other gas flow control valve clockwise until the flow rate is zero.

4.5.18 Place the knob on the flow control valve shaft and turn it clockwise until it engages the stop pin. Tighten one of the knob setscrews.

4.5.19 Turn the knob in both directions and ensure that the flow can be controlled over its entire range. When the valve is closed, the knob should be against the clockwise stop. Tighten the remaining set screw.

4.5.20 If the knob label is not horizontal when the valve is closed, remove the label and install a new label in the correct position.

4.5.21 Perform the PMS Procedure given in Section 6.

4.6 Oxygen Supply Failure Protection Device

The air and nitrous oxide supplies within the machine are monitored by oxygen supply failure protection devices (OFPDs) which prevent the flow of these gases if there is insufficient oxygen pressure available. Access to these devices requires disassembly in the flowmeter sub-assembly area. See Figure 4-6.

4.6.1 Disconnect all pipeline hoses and turn the System Power switch to ON.

4.6.2 Open the oxygen cylinder valve.

4.6.3 Set the oxygen flow to 5 liters per min.

4.6.4 Open the other gas flow control valves to drain pressure from the system.

4.6.5 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.6.6 Turn the System Power switch to STANDBY.

4.6.7 Remove the oxygen flow control knob.

4.6.8 Remove the two screws holding the knob guard in place, and remove the knob guard.

4.6.9 Remove the plexiglass flowmeter shield.

4.6.10 Remove the flowmeter housing back cover. Be sure to disconnect the ventilator exhaust hose.

4.6.11 Ref. Figure 4-2A: Disconnect the copper tubing at points **A**, **B**, **C** and **D**.

4.6.12 Remove the four screws securing the flowmeter sub-assembly to the flowmeter housing.

4.6.13 Pull the flowmeter sub-assembly forward far enough to gain access to the OFPDs.

4.6.14 Remove the press-on hose clamp and disconnect the small diameter tubing from the hose barb at the top of the OFPD.

4.6.15 Air OFPD: Remove the three screws securing the OFPD to the flowmeter sub-assembly, and remove the OFPD.

NOTE: The N_2O OFPD has longer mounting screws, which pass through the oxygen ratio controller (ORC) and into the flowmeter sub-assembly. These screws retain both devices.

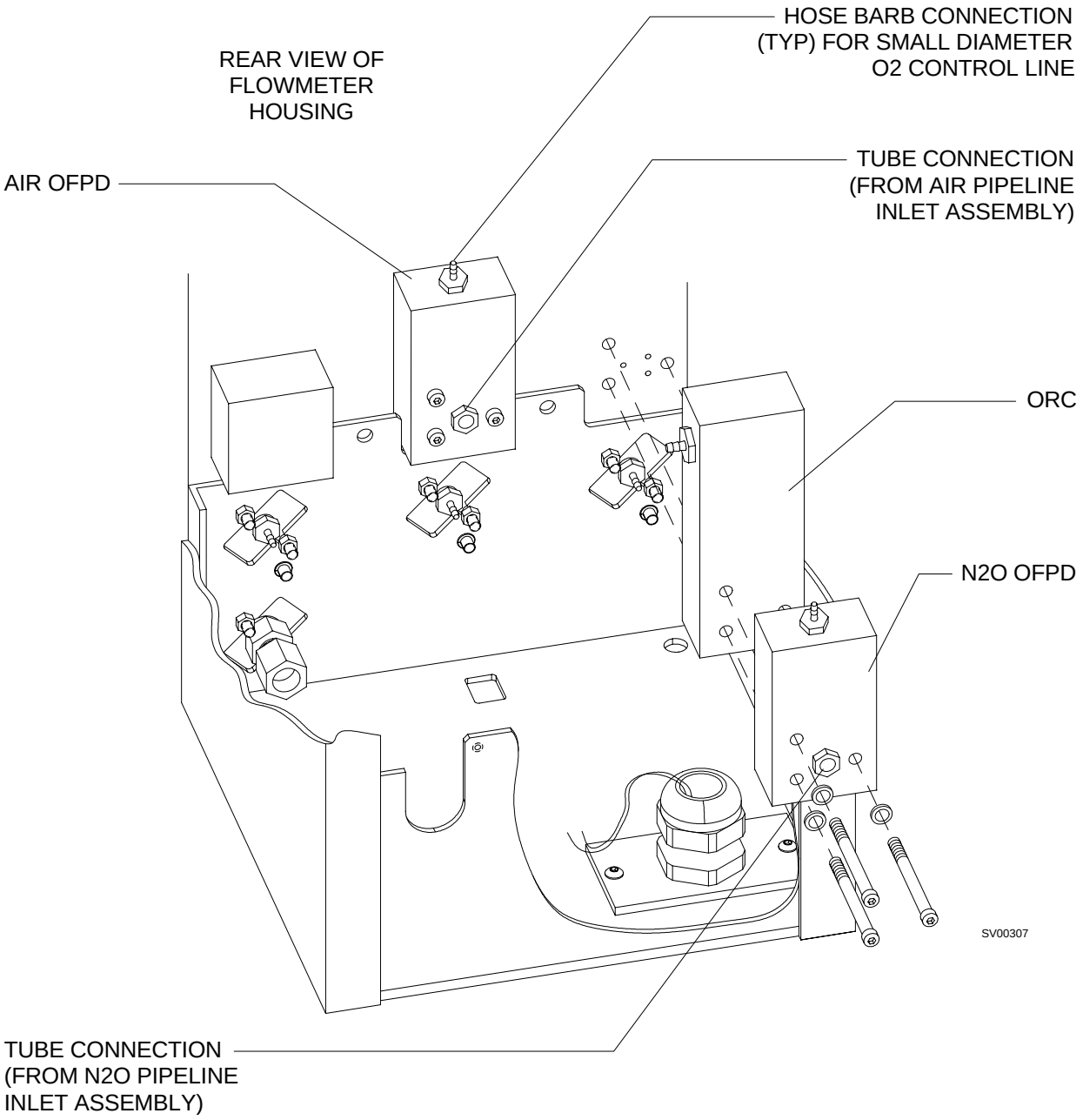


Figure 4-6. OFPD Replacement

N_2O OFPD: Remove the three screws securing the OFPD, and remove the OFPD.

4.6.16 Ensure that the O-ring is correctly in place, and install the replacement OFPD with the hardware that was previously removed.

4.6.17 Reconnect the small diameter tubing to the hose barb on the OFPD and secure the connection with the press-on hose clamp.

4.6.18 Reinstall the flowmeter sub-assembly, and reconnect all copper tubing.

4.6.19 Reinstall the front plexiglass flowmeter shield.

4.6.20 Reinstall the knob guard and secure it with the two mounting screws.

4.6.21 Reinstall the oxygen flow control knob. Re-set the 'off stop' with the label oriented correctly.

4.6.22 Reconnect the ventilator exhaust hose and reinstall the flowmeter housing back cover.

4.6.23 Connect the pipeline supplies.

4.6.24 Perform the PMS Procedure given in Section 6.

4.7 Oxygen Supply Pressure Alarm Switch

The oxygen supply low pressure alarm switch is located inside the flowmeter housing, attached to a bracket on the flowmeter sub-assembly. Access to the switch requires removal of the flowmeter housing back cover. Figure 4-7 shows the pneumatic and electrical connections to the switch.

4.7.1 Turn the System Power switch to STANDBY and disconnect the pipeline hoses.

4.7.2 Remove the flowmeter housing back cover. Be sure to disconnect the ventilator exhaust hose.

4.7.3 Separate the in-line connector on the switch wire harness.

4.7.4 Remove the press-on hose clamp and disconnect the tubing from the hose barb on the bottom of the switch.

4.7.5 Loosen the four screws holding the switch to the bracket; lift out the switch and screws.

4.7.6 Transfer the screws to the replacement switch; position the switch on the bracket, and tighten the four screws to secure the switch to the bracket.

4.7.7 Reconnect the tubing to the hose barb on the switch and secure it with the press-on clamp.

4.7.8 Join the in-line connector to its corresponding wire harness.

4.7.9 Perform the oxygen supply pressure alarm switch adjustment procedure given in Section 5 of this manual.

4.7.10 Reinstall the flowmeter housing back cover.

4.7.11 Perform the PMS procedure given in Section 6.

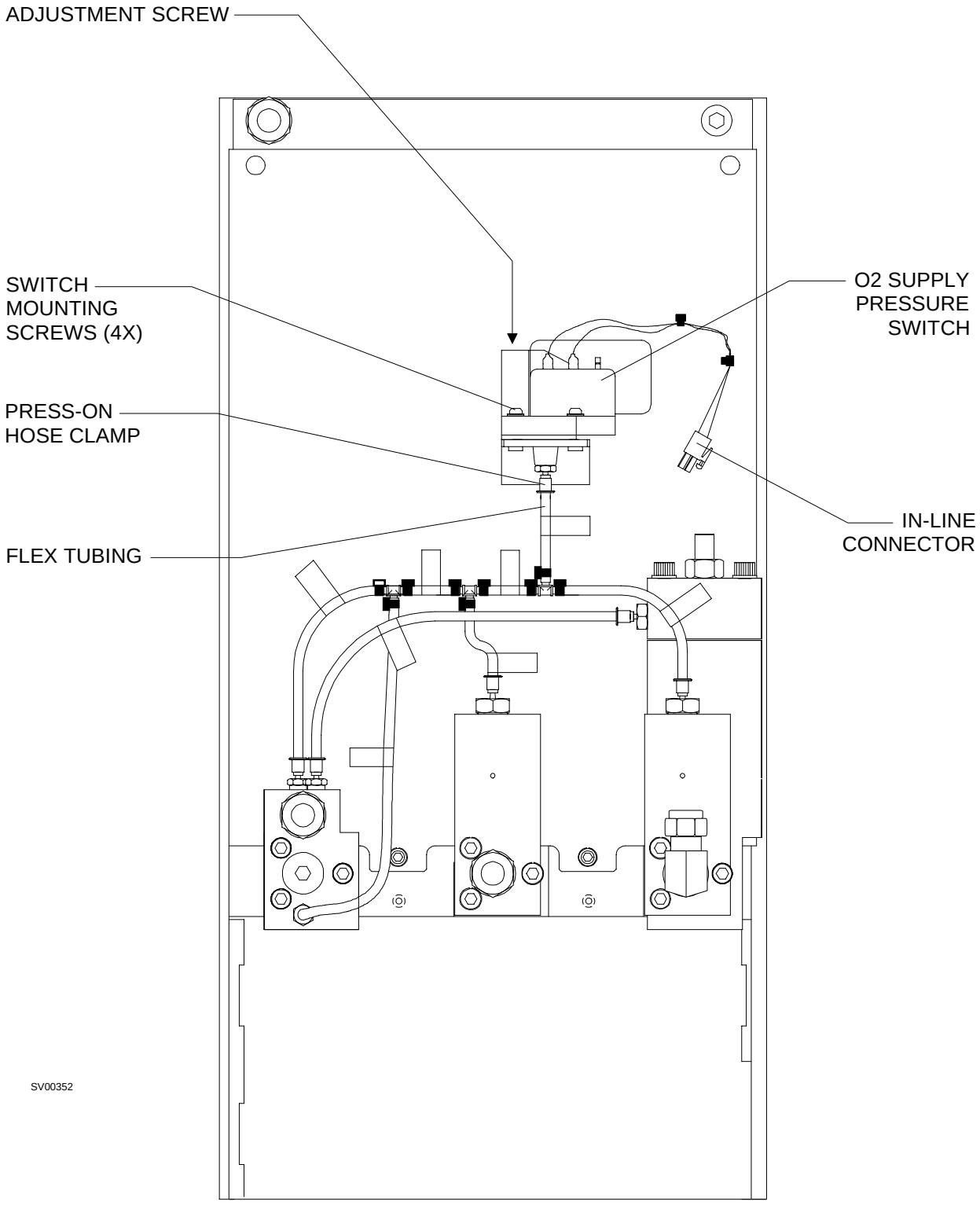


Figure 4-7. Oxygen Supply Pressure Alarm Switch

4.8 O_2 - Air Switch

The ventilator drive gas (O_2 - Air) selector is a manually operated pneumatic switch located at the opening at the side of the flowmeter housing. The switch is attached to a recess housing fixed to the inside wall of the flowmeter housing. Access to the switch requires removal of the flowmeter housing back cover. Figure 4-8 shows the mounting arrangement and connections.

4.8.1 Disconnect all pipeline hoses and turn the System Power switch to ON.

4.8.2 Open the oxygen cylinder valve.

4.8.3 Set the oxygen flow to 5 liters per min.

4.8.4 Open the other gas flow control valves to drain pressure from the system.

4.8.5 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.8.6 Turn the System Power switch to STANDBY.

4.8.7 Disconnect the copper tube at the upper port of the Air pipeline inlet assembly (marked **A** in the illustration).

4.8.8 Disconnect the copper tube (O_2) from the O_2 port at the switch.

4.8.9 Remove the two screws securing the switch bracket.

4.8.10 In the recess housing, remove the panel nut and lock washer from the switch.

4.8.11 Pull the switch out far enough to gain access to the output port; disconnect the flex tubing and remove the switch from the flowmeter housing.

4.8.12 Remove the copper tube (Air) from the switch, and transfer it to the replacement switch.

4.8.13 Transfer the recess housing (around the switch handle) to the replacement switch.

4.8.14 Place the switch bracket over the switch and position the replacement switch in the flowmeter housing. Reconnect the flex tubing to the output port on the switch.

4.8.15 Reinstall the bracket screws that were previously removed.

4.8.16 Connect the O_2 copper tube to the O_2 port on the switch.

4.8.17 Connect the Air copper tube to the upper port of the Air pipeline inlet assembly. Tighten all copper tube compression fittings.

4.8.18 Reinstall the flowmeter housing back cover.

4.8.19 Perform the PMS Procedure given in Section 6.

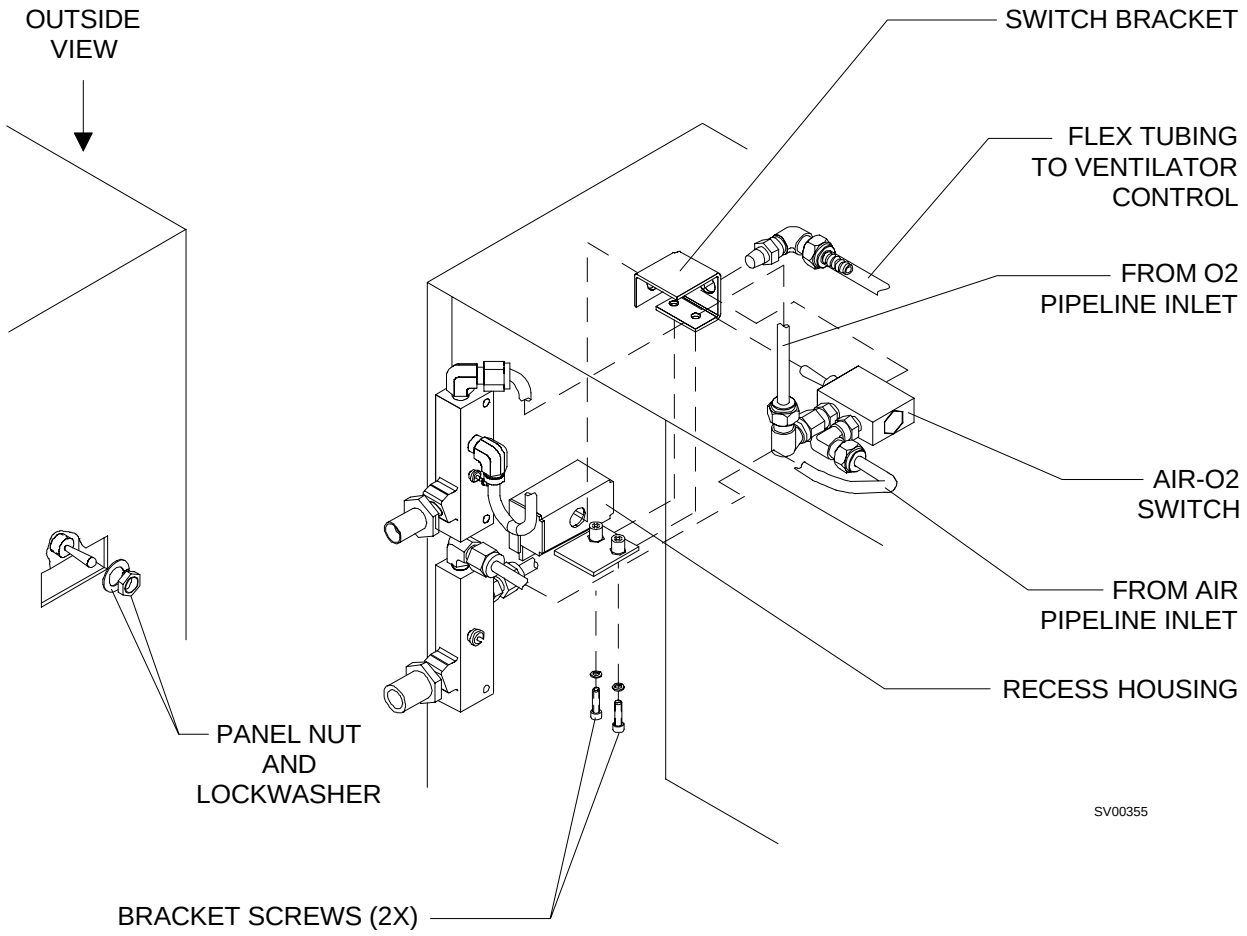


Figure 4-8. O2 - Air Switch

4.9 System Power Switch

The system power switch assembly is located in the power supply housing. Access to the switch assembly requires that the machine be separated from its support frame, and removal of the power supply. Figure 4-9 shows the connection and mounting arrangement for the switch assembly.

4.9.1 Disconnect all pipeline hoses and turn the System Power switch to ON.

4.9.2 Open the oxygen cylinder valve.

4.9.3 Set the oxygen flow to 5 liters per min.

4.9.4 Open the other gas flow control valves to drain pressure from the system.

4.9.5 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.9.6 Turn the System Power switch to STANDBY.

4.9.7 Remove the following items from the machine: external monitors, cylinders, vaporizer and display.

4.9.8 Disconnect the fresh gas hose.

4.9.9 Disconnect the ventilator breathing and scavenger hoses, and the sensor interface connections.

4.9.10 Loosen the wingnut on the absorber arm, and remove the absorber assembly.

4.9.11 Ref. Figure 4-16A: separate the machine from its support frame.

4.9.12 Ref. Paragraph 4.16.8: remove the power supply assembly from its housing.

4.9.13 Carefully place the machine upside-down on a suitable surface.

4.9.14 Disconnect the tubing at the three compression fittings on the switch assembly (see Figure 4-9).

4.9.15 Locate the 2-pin in-line connector that joins the switch wires to the main harness (orange and violet wires).

Separate this in-line connector.

4.9.16 Release the two switch wire pins from the connector body, and retrieve the switch wires through the bulkhead bushing.

REPLACEMENT PROCEDURES (continued)

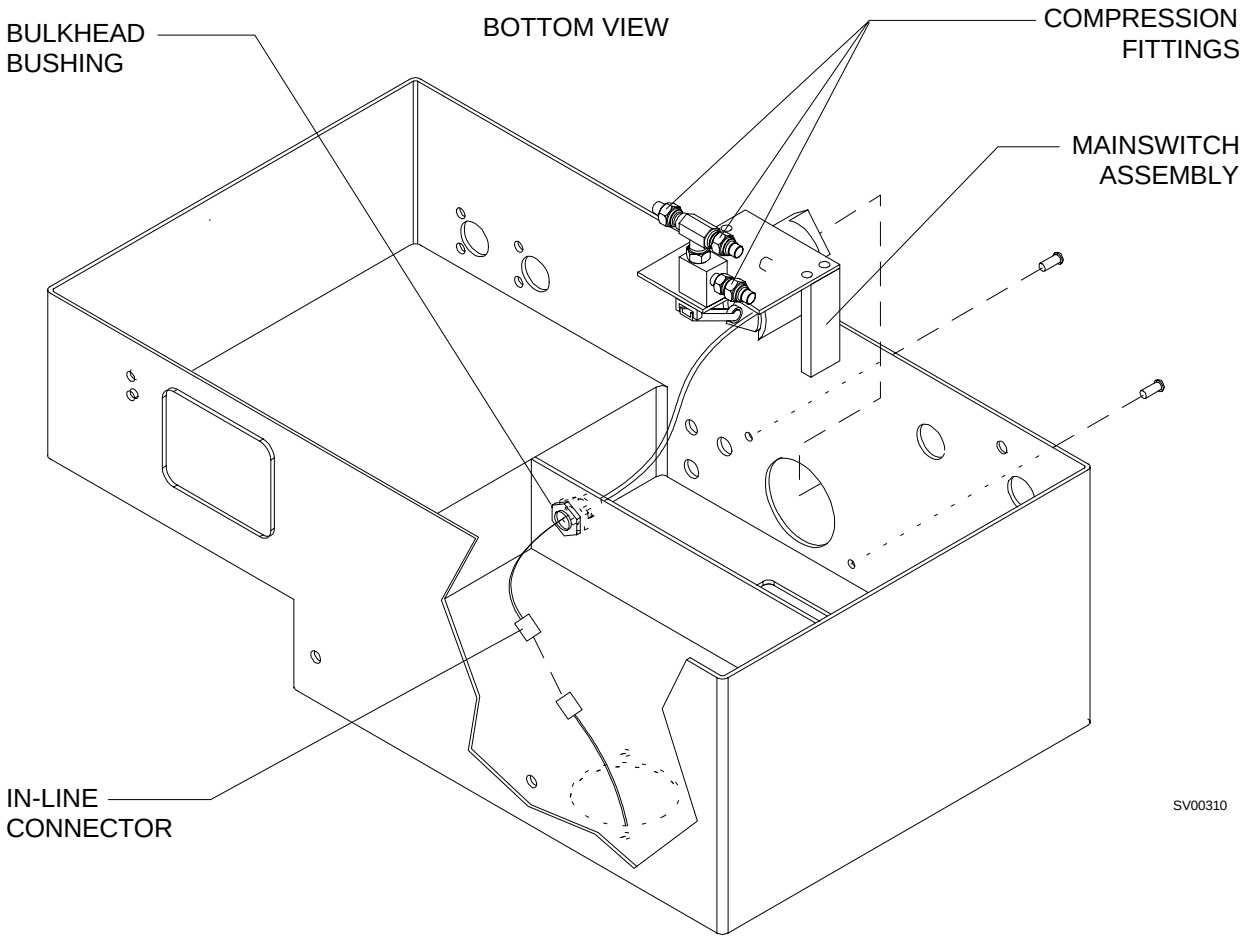


Figure 4-9. System Power Switch

4.9.17 Remove the two screws securing the switch assembly to the power supply housing, and remove the switch assembly from the housing.

4.9.18 Install the replacement switch assembly in the power supply housing and secure it with the hardware that was previously removed.

4.9.19 Route the switch wires through the bulkhead bushing in the same manner as the original, and install the pins in the connector body: violet wire in Position #1, orange wire in Position #2.

4.9.20 Join the in-line connector.

4.9.21 Re-connect the tubing to the compression fittings on the replacement switch assembly.

4.9.22 Ref. Paragraph 4.16.8: reinstall the power supply assembly.

4.9.23 Ref. Figure 4-16A: reattach the machine to its support frame.

4.9.24 Reinstall the absorber assembly and reconnect the fresh gas hose.

4.9.25 Reinstall the display, vaporizer and cylinders.

4.9.26 Reinstall all accessories that were previously removed; restore all breathing, scavenger and sensor interface connections. Refer to the Installation Instructions in the *Narkomed Mobile Setup and Installation Manual.*

4.9.27 Reconnect the pipeline supplies.

4.9.28 Restore AC power to the machine and ensure that new system power switch is working properly.

4.9.29 Perform the PMS Procedure given in Section 6.

4.10 Oxygen Ratio Controller

The Oxygen Ratio Controller (ORC) is part of the N_2O flowmeter sub-assembly and is located within the flowmeter housing. Access to the ORC requires disassembly in the flowmeter sub-assembly area, and removal of the N_2O OFPD assembly. Figure 4-10 shows the ORC location and mounting arrangement.

4.10.1 Disconnect all pipeline hoses and turn the System Power switch to ON.

4.10.2 Close all cylinder valves except the O_2 cylinder.

4.10.3 Set the oxygen flow to 5 liters per min.

4.10.4 Open the other gas flow control valves to drain pressure from the system.

4.10.5 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.10.6 Turn the System Power switch to STANDBY.

4.10.7 Remove the oxygen flow control knob.

4.10.8 Remove the two screws holding the knob guard in place, and remove the knob guard.

4.10.9 Remove the plexiglass flowmeter shield.

4.10.10 Remove the flowmeter housing back cover. Be sure to disconnect the ventilator exhaust hose.

4.10.11 Ref. Figure 4-2A: Disconnect the copper tubing at points **A**, **B**, **C** and **D**.

4.10.12 Remove the four screws securing the flowmeter sub-assembly to the flowmeter housing.

4.10.13 Pull the flowmeter sub-assembly forward far enough to gain access to the OFPDs.

4.10.14 Remove the press-on hose clamp and disconnect the small diameter tubing from the hose barb at the top of the OFPD.

4.10.15 Remove the press-on hose clamp and disconnect the small diameter tubing from the hose barb on the side of the ORC.

NOTE: The N_2O OFPD has long mounting screws, which pass through the oxygen ratio controller (ORC) and into the flowmeter sub-assembly. These screws retain both devices.

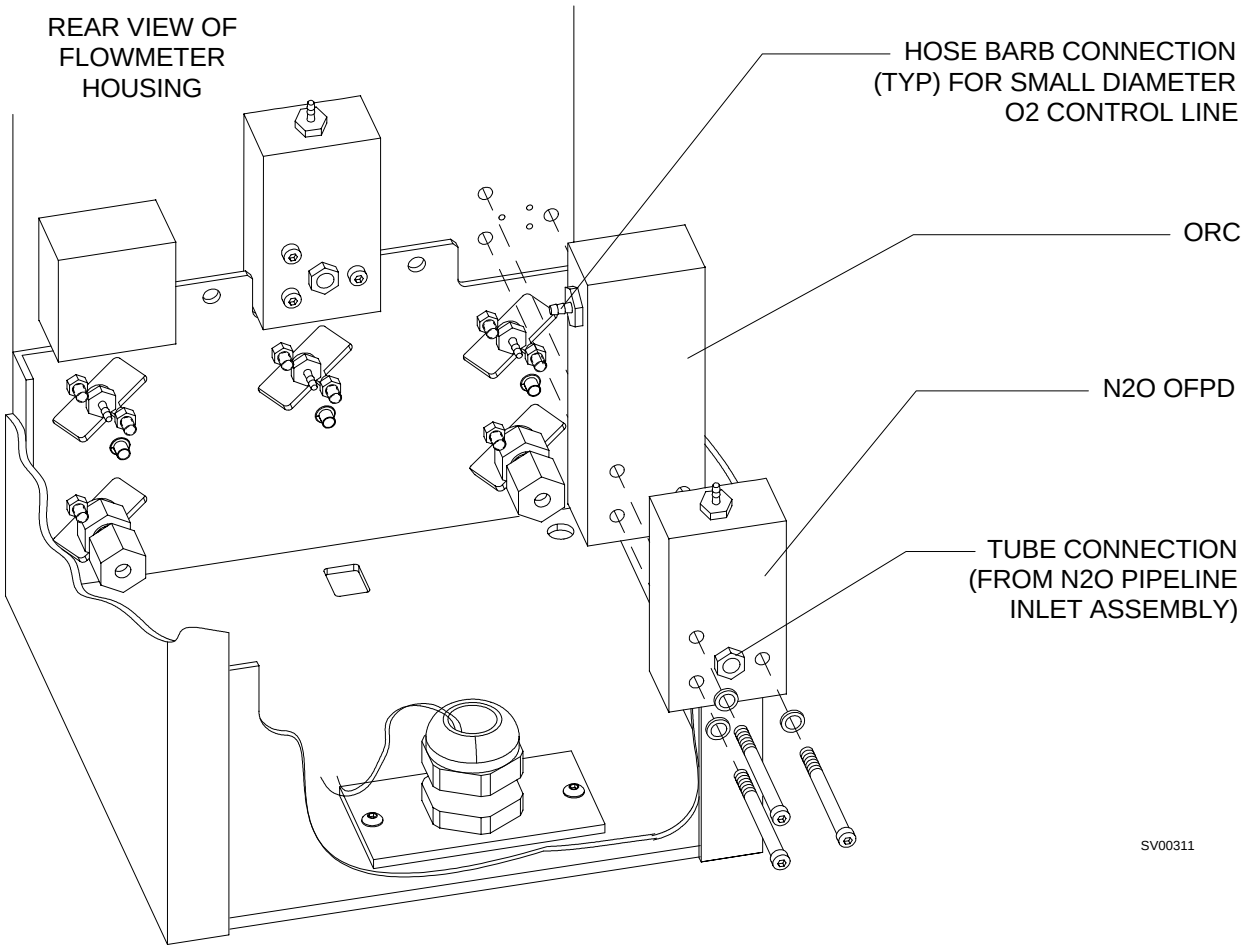


Figure 4-10. Oxygen Ratio Controller

4.10.16 Remove the three screws securing the OFPD and the ORC, and remove the OFPD and ORC.

4.10.17 Position the replacement ORC at the back of the N_2O flowmeter sub-assembly; be sure that its O-rings and filter are in place. Reinstall the OFPD, with the mounting screws going through the ORC and into the flowmeter sub-assembly. Tighten the screws.

4.10.18 Reconnect the small diameter tubing to the ORC and secure the connection with the press-on hose clamp.

4.10.19 Reconnect the small diameter tubing to the hose barb on the OFPD and secure the connection with the press-on hose clamp.

4.10.20 Reinstall the flowmeter sub-assembly, and reconnect all copper tubing.

4.10.21 Reinstall the front plexiglass flowmeter shield.

4.10.22 Reinstall the knob guard and secure it with the two mounting screws.

4.10.23 Reinstall the oxygen flow control knob. Re-set the 'off stop' with the label oriented correctly.

4.10.24 Reconnect the ventilator exhaust hose and reinstall the flowmeter housing back cover.

4.10.25 Connect the pipeline supplies.

4.10.26 Perform the PMS Procedure given in Section 6.

4.11 O_2 Flush Valve

The O_2 flush valve is located at the front of the machine next to the fresh gas outlet. Access to the flush valve is through the bottom of the machine, which requires removal of the power supply assembly. You will need to remove the machine from its support frame. Figure 4-11 shows the mounting arrangement of the O_2 flush valve and its tubing connections.

4.11.1 Disconnect all pipeline hoses and turn the System Power switch to ON.

4.11.2 Close the O_2 cylinder valve and the O_2 flow control valve. Press the O_2 Flush valve to drain oxygen pressure from the system.

4.11.3 Turn the System Power switch to STANDBY, and disconnect the AC power cord.

4.11.4 Remove the following items from the machine: external monitors, cylinders, vaporizer and display.

4.11.5 Disconnect the fresh gas hose.

4.11.6 Disconnect the ventilator breathing and scavenger hoses, and the sensor interface connections.

4.11.7 Loosen the wingnut on the absorber arm, and remove the absorber assembly.

4.11.8 Ref. Figure 4-16A: separate the machine from its support frame.

4.11.9 Ref. Paragraph 4.16.8: remove the power supply assembly from its housing.

4.11.10 Carefully place the machine upside-down on a suitable surface.

4.11.11 Hold the O_2 Flush button in and rotate it until one of its set screws are visible through an access hole in the guard ring, and loosen the set screw.

4.11.12 Turn the O_2 Flush button 180 degrees, hold it in and loosen the other set screw.

4.11.13 Remove the O_2 Flush button and washer from the valve shaft.

4.11.14 Disconnect the compression fittings at the valve.The O_2 Flush valve is retained by the guard ring on the front of the machine. Hold the body of the Clippard valve with an open end wrench; insert a rod or hex wrench through the holes in the guard ring (or use a spanner wrench), and un-screw the guard ring.

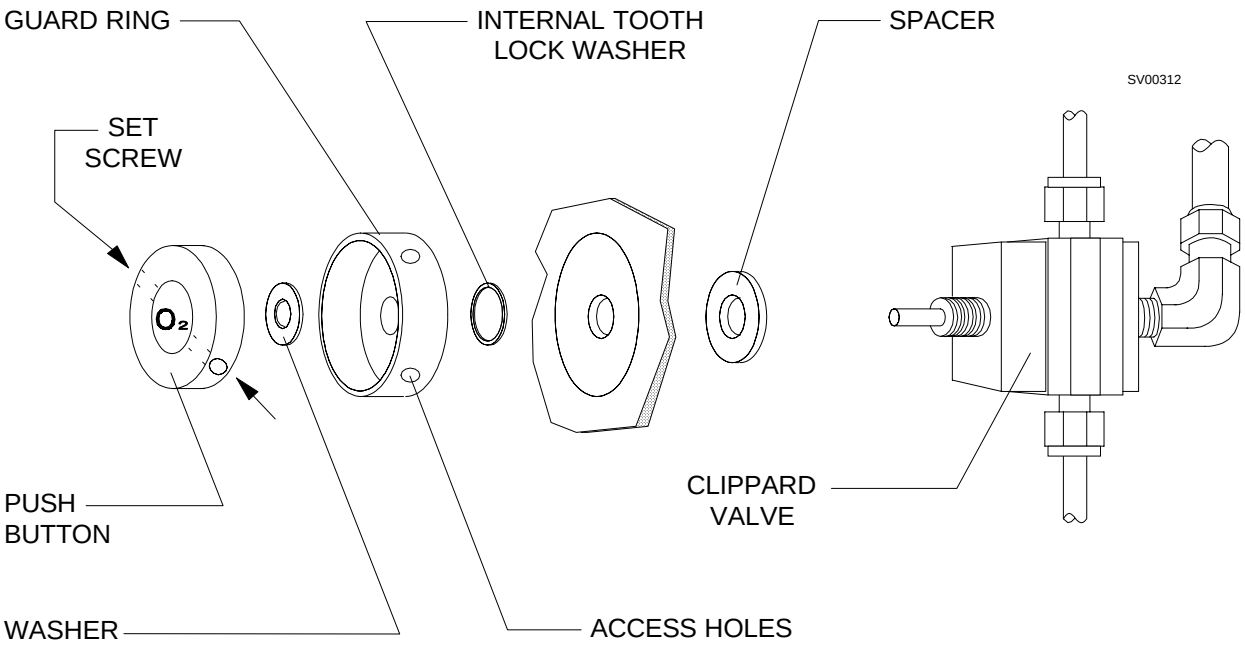


Figure 4-11. O_2 Flush Valve

4.11.15 Assemble the replacement O_2 Flush valve, spacer, internal tooth lock washer and guard ring through the chassis and tighten the assembly, making sure that the valve is mounted straight. Connect the compression fittings to the valve.

4.11.16 Place the washer and the O_2 Flush button on the valve shaft.

4.11.17 Hold the O_2 Flush button in and turn it until a set screw is visible through an access hole in the guard ring. Tighten the set screw. Rotate the button 180 degrees until the other set screw is visible, and tighten the set screw.

4.11.18 Ref. Paragraph 4.16.8: reinstall the power supply assembly.

4.11.19 Ref. Figure 4-16A: reattach the machine to its support frame.

4.11.20 Reinstall the absorber assembly and reconnect the fresh gas hose.

4.11.21 Reinstall the display, vaporizer and cylinders.

4.11.22 Reinstall all accessories that were previously removed; restore all breathing, scavenger and sensor interface connections. Refer to the Installation Instructions in the *Narkomed Mobile Setup and Installation Manual.*

4.11.23 Connect a test gauge and B.P. bulb to the fresh gas outlet, and perform the following test:

4.11.23.1 Open the oxygen cylinder valve and allow the pressure to stabilize. (The cylinder pressure must be at least 1000 psi for this test.)

4.11.23.2 Release any pressure that is indicated on the test gauge.

4.11.23.3 Over the next 60 seconds, the test gauge should not show a pressure increase greater than 2 cm H_2O.

4.11.23.4 Increase the pressure to 50 cm H_2O.

4.11.23.5 The pressure should not drop more than 10 cm H_2O in the next 30 seconds.

4.11.23.6 Disconnect the test gauge from the fresh gas outlet.

4.11.23.7 Close the oxygen cylinder valve.

4.11.23.8 The pressure should not drop more than 50 psi in two minutes.

4.11.23.9 Connect a volumeter to the fresh gas outlet, and reset the volumeter to zero.

4.11.23.10 Press the O_2 Flush button and observe the flow rate. It should be between 45 and 65 liters per minute.

4.11.23.11 Disconnect the volumeter from the fresh gas outlet.

4.11.24 Connect the absorber fresh gas hose to the fresh gas outlet.

4.11.25 Connect the pipeline hoses.

4.11.26 Perform the PMS Procedure given in Section 6.

4.12 Ventilator Controller (Bezel Assembly)

The ventilator controller assembly is attached to the inner shelf above the flowmeter housing and bellows box. Figure 4-12 shows the mounting screw locations, pneumatic and electrical connections to the ventilator controller.

4.12.1 Turn the System Power switch to STANDBY and remove AC power from the machine.

4.12.2 Disconnect all pipeline hoses and close the cylinder valves.

CAUTION: The controller circuit board contains static sensitive devices. Use ESD protection when handling the controller assembly. Static discharge can damage components on the circuit board.

4.12.3 Remove the flowmeter housing back cover. Be sure to disconnect the ventilator exhaust hose.

4.12.4 Remove the two screws holding the ventilator controller chassis to the inside shelf; remove the two screws holding the hex standoffs attached to the controller assembly. You will need to open the battery compartment and remove the battery for access to one of the screws.

4.12.5 Pull the assembly out from the front of the machine far enough to gain access to its connections.

4.12.6 Disconnect tube **D** from the fitting at the bottom of the inspiratory flow regulator.

4.12.7 Disconnect the power wiring harness from J2 on the controller circuit board.

4.12.8 Disconnect the switch and solenoid wiring harness from J1 on the controller circuit board.

4.12.9 Disconnect tube **B** from the fitting at the diaphragm valve.

4.12.10 Disconnect small diameter tubes **A** and **C**, and remove the controller assembly from the machine.

4.12.11 Position the replacement controller assembly at the front of the ventilator box and reconnect the four pneumatic lines.

4.12.12 Reconnect wire harnesses to J1 and J2 on the controller circuit board.

4.12.13 Slide the controller into the ventilator box until it is properly seated.

4.12.14 Reinstall the two screws to secure the controller chassis to the shelf.

4.12.15 Reinstall the two screws holding the hex standoffs, and reinstall the battery.

4.12.16 Reconnect the ventilator exhaust hose and reinstall the flowmeter housing back cover.

4.12.17 Perform the PMS Procedure given in Section 6.

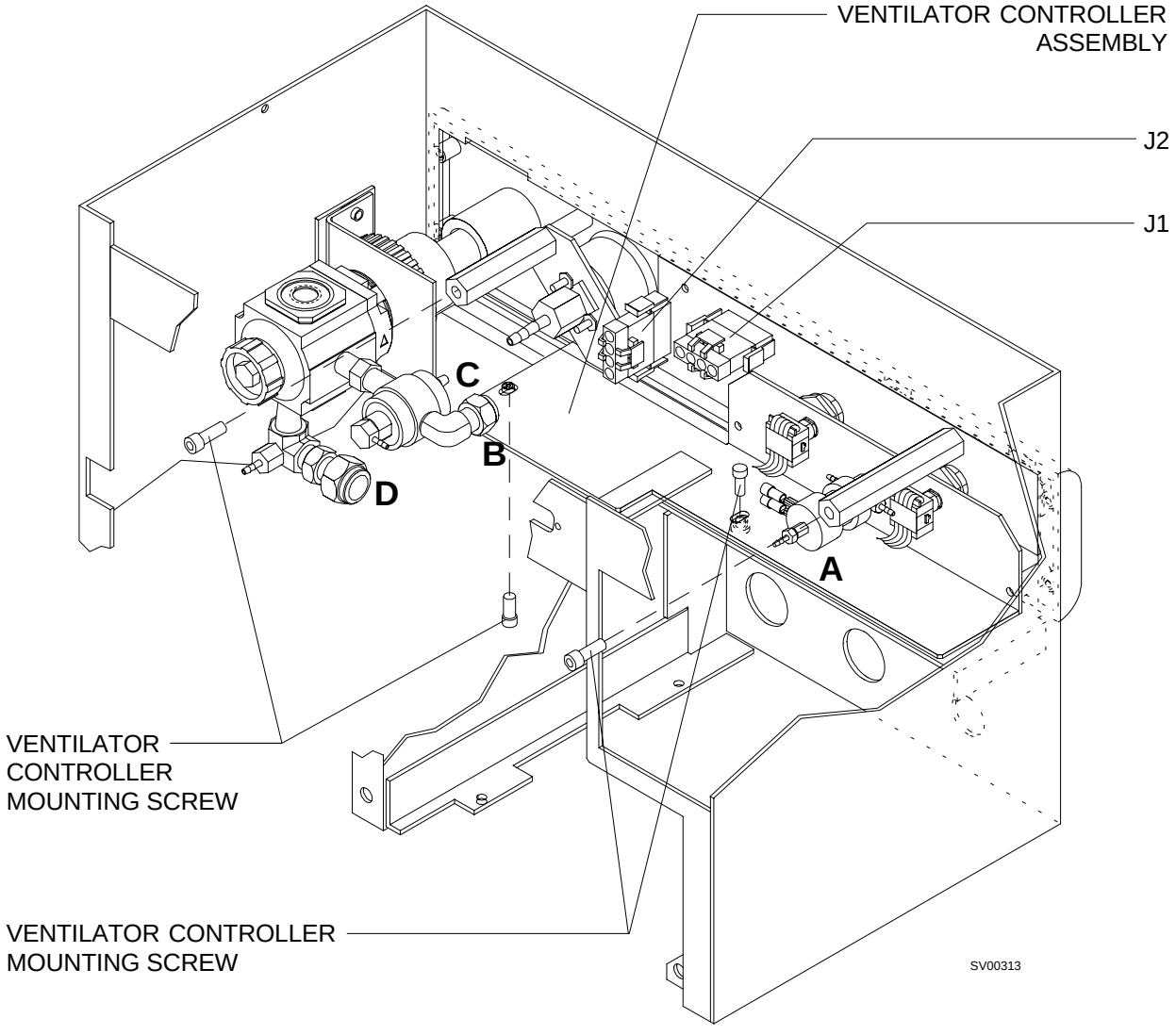


Figure 4-12. Ventilator Controller (Bezel Assembly)

4.13 Bellows Valve Assembly

The bellows valve assembly is located in the bellows box directly above the bellows canister. Access to the valve assembly requires removal of the flowmeter housing back cover (which also covers the bellows box). Figure 4-13 shows the pneumatic connections and mounting arrangement of the valve assembly.

4.13.1 Turn the System Power switch to STANDBY and remove AC power from the machine.

4.13.2 Remove the flowmeter housing back cover.

4.13.3 Adjust the TIDAL VOLUME control to raise the volume indicator to its maximum setting.

4.13.4 Disconnect the breathing hose and the scavenger hose from the bellows assembly. Loosen the wing nuts and remove the bellows assembly.

4.13.5 Remove the canister from the bellows box by pulling it downward. (It is a press-fit.)

4.13.6 Disconnect tube **B** from the venturi, and tube **C** from the auto-ranging valve.

4.13.7 Remove the four screws securing the valve assembly to the bellows box.

4.13.8 Pull the valve assembly toward the back of the machine until the bottom plate of the assembly is able to drop down through the cutouts in the bottom lip on each side of the bellows box.

4.13.9 Install the replacement valve assembly - slide the assembly up into the bellows box and forward into position. (It may be necessary to rotate the pressure limit and tidal volume knobs until their drive slots are aligned with the shaft pins, in order to move the valve assembly into its correct position.)

4.13.10 Secure the valve assembly to the bellows box with the hardware that was previously removed.

4.13.11 Reconnect the tubing to the venturi, and the auto-ranging valve.

4.13.12 Reinstall the canister in the bellows box. Ensure that the markings are facing forward.

4.13.13 Reinstall the bellows assembly and tighten the wing nuts.

4.13.14 Reconnect the breathing and scavenger hoses to the bellows assembly.

4.13.15 Reinstall the flowmeter housing back cover.

4.13.16 Perform the PMS Procedure given in Section 6.

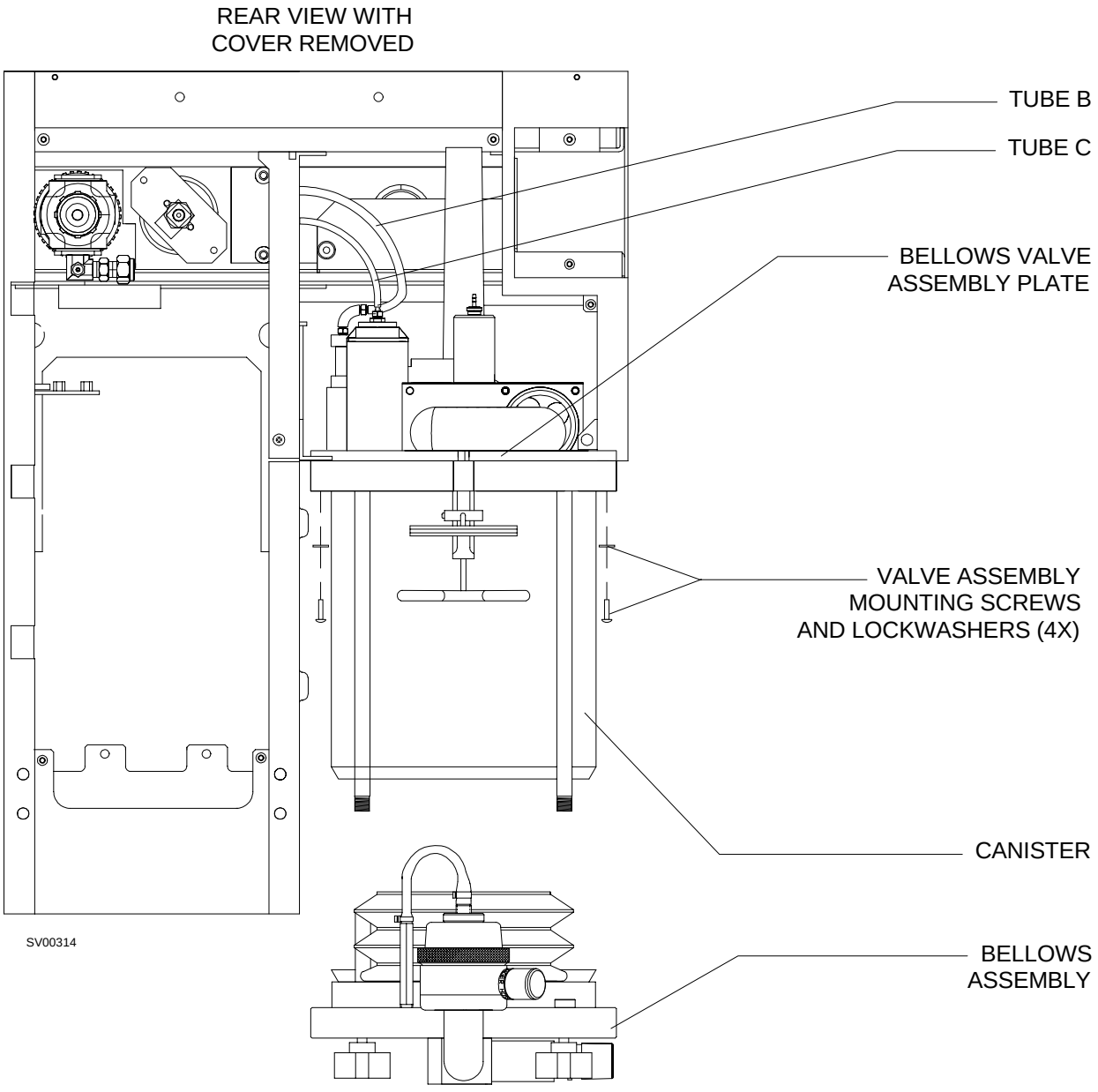


Figure 4-13. Bellows Valve Assembly

4.14 Caster Replacement

Each caster is retained by a set screw in the side of the lower frame rail as shown in Figure 4-14. Caster replacement requires that the machine be tilted to provide enough clearance for the caster stem to be withdrawn from the bottom of the frame rail.

WARNING: Do not tilt the machine more than 10 degrees or raise the casters more than 3½ inches from the floor. Failure to observe this precaution may result in a tip-over, causing personal injury. Vaporizers containing anesthetic agent may also be damaged.

4.14.1 Obtain a brace capable of supporting one side of the machine with its casters two to three inches from the floor.

4.14.2 Remove all unsecured equipment and accessories from the machine.

4.14.3 Lock the front casters.

4.14.4 Using at least two people, tilt the machine until the casters on one side are raised two to three inches from the floor, and position the support brace under the frame rail between the front and back casters.

4.14.5 Loosen the set screw until the caster can be removed.

4.14.6 Insert the replacement caster into the frame; align the threaded hole in the caster stem with the hole in the frame rail.

4.14.7 Tighten the caster stem set screw.

4.14.8 Using at least two people, tilt the machine, remove the support brace and carefully lower the machine to the floor.

4.14.9 Check for proper operation of the caster and ensure that the front casters lock properly.

4.14.10 Perform the PMS Procedure given in Section 6, including a vaporizer calibration verification.

4.14.11 Replace any unsecured equipment and accessories that were previously removed.

REPLACEMENT PROCEDURES (continued)

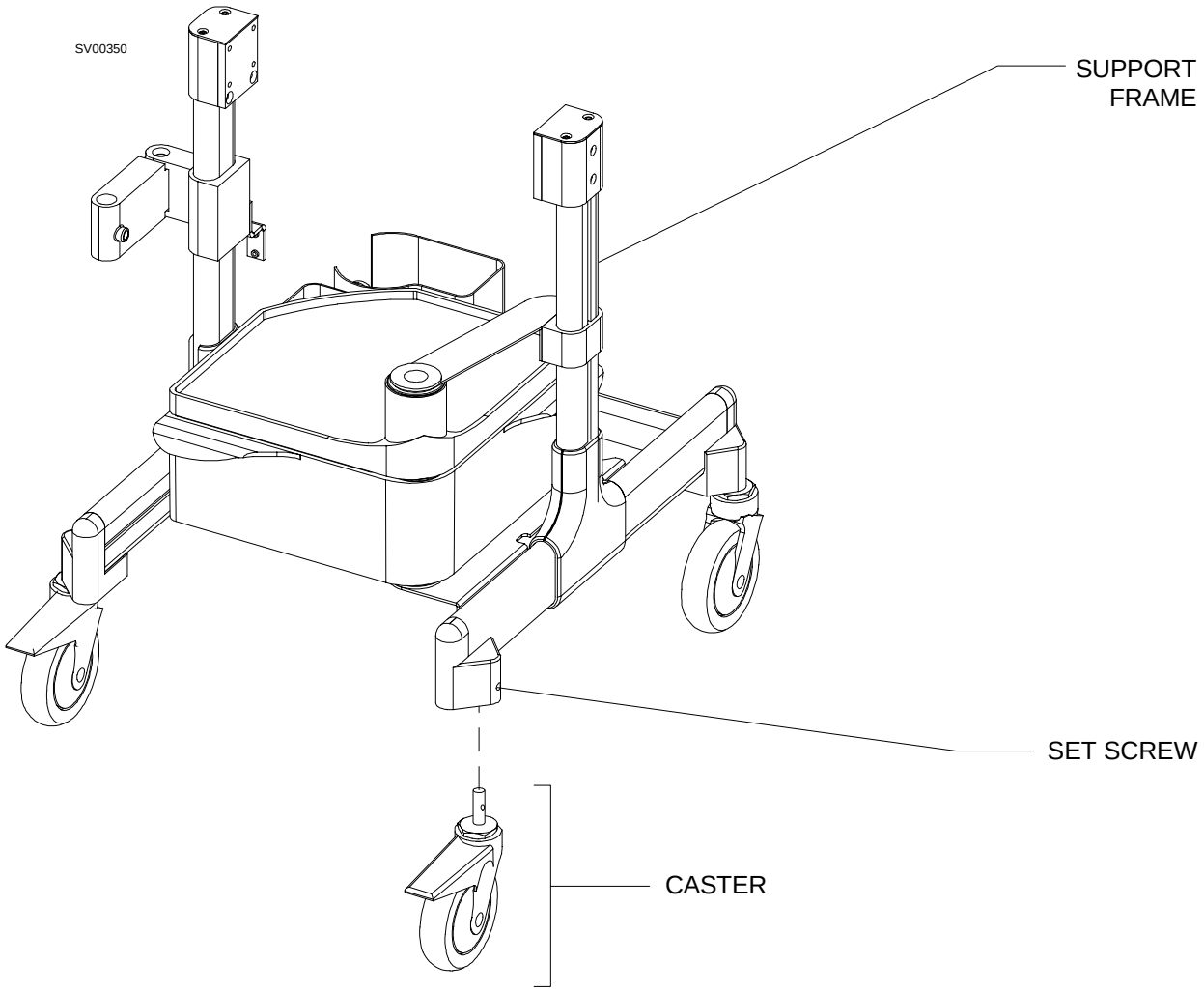


Figure 4-14. Caster Replacement

4.15 Battery Replacement

The battery is located in a compartment accessible at the back of the bellows box. Figure 4-15 shows the battery compartment door and battery wiring arrangement.

4.15.1 Turn the System Power switch to STANDBY and remove AC power from the machine.

4.15.2 Unscrew the two captive mounting screws on the battery compartment door, and remove the door.

4.15.3 Pull the battery from its compartment; note the wire colors and positions, and disconnect the wires from the tabs on the battery.

4.15.4 Connect the wires to the replacement battery in the same manner as the original, and install the battery in the battery compartment.

4.15.5 Reinstall the battery compartment door and secure it with the two captive mounting screws.

4.15.6 Restore AC power to the machine to allow the battery to charge. Allow 12 hours charging time for a fully discharged battery.

End of life battery disposal:

Dispose of the spent rechargeable, sealed lead-acid battery in conformance with local waste disposal regulations.

REPLACEMENT PROCEDURES (continued)

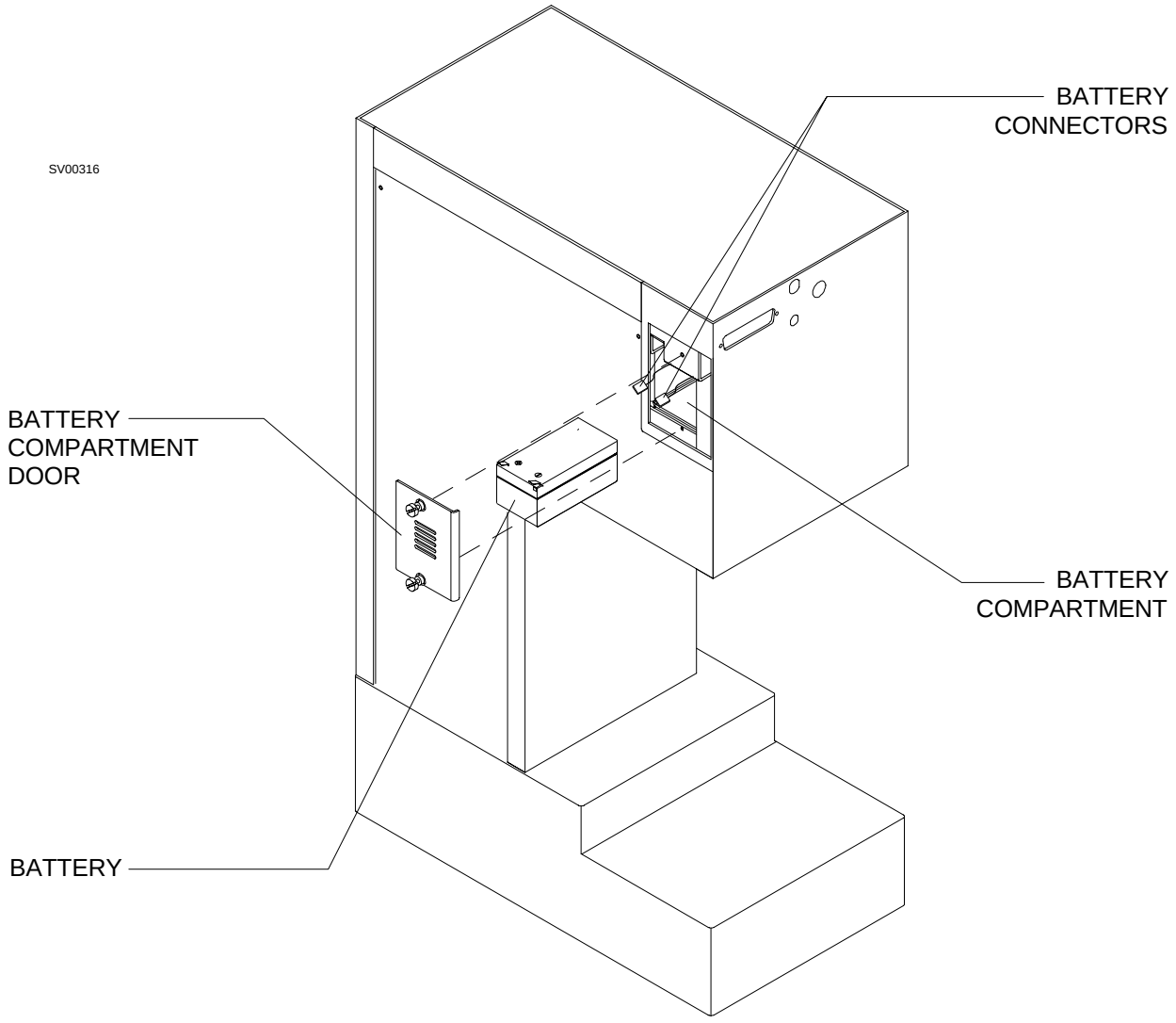


Figure 4-15. Battery Replacement

4.16 Power Supply Assembly

The power supply assembly comprises the power inlet connector, circuit breakers, primary power supply and regulator PCB. It is field serviced by replacing the complete assembly. You will need to remove the machine from its support frame for access to the power supply assembly. Figure 4-16 shows the mounting arrangement and electrical connections.

4.16.1 Disconnect all pipeline hoses and close all cylinder valves.

WARNING: Ensure that AC power is removed from the machine before removing the power supply. Failure to observe this precaution may cause injury by electric shock.

4.16.2 Turn the System Power switch to STANDBY and disconnect the AC power cord from the power inlet on the back of the machine.

4.16.3 Disable the circuit breakers by pulling out each button with a knife or sharp object.

4.16.4 Remove the following items from the machine: external monitors, cylinders, vaporizer and display.

4.16.5 Disconnect the fresh gas hose.

4.16.6 Disconnect the ventilator breathing and scavenger hoses, and the sensor interface connections.

4.16.7 Loosen the wingnut on the absorber arm, and remove the absorber assembly.

4.16.8 Separate the machine from its support frame as follows (see Figure 4-16A):

4.16.8.1 Remove the two drawer support screws.

4.16.8.2 Loosen (do not remove) the two vertical support arm screws on the inside of the support frame, on each side.

4.16.8.3 Carefully lift the anesthesia machine from the support frame (the vertical support arms remain attached to the machine).

4.16.9 Carefully place the machine upside-down on a suitable surface.

4.16.10 Remove the six screws holding the power supply assembly to the housing, and lift out the assembly far enough for access to its cables.

REPLACEMENT PROCEDURES (continued)

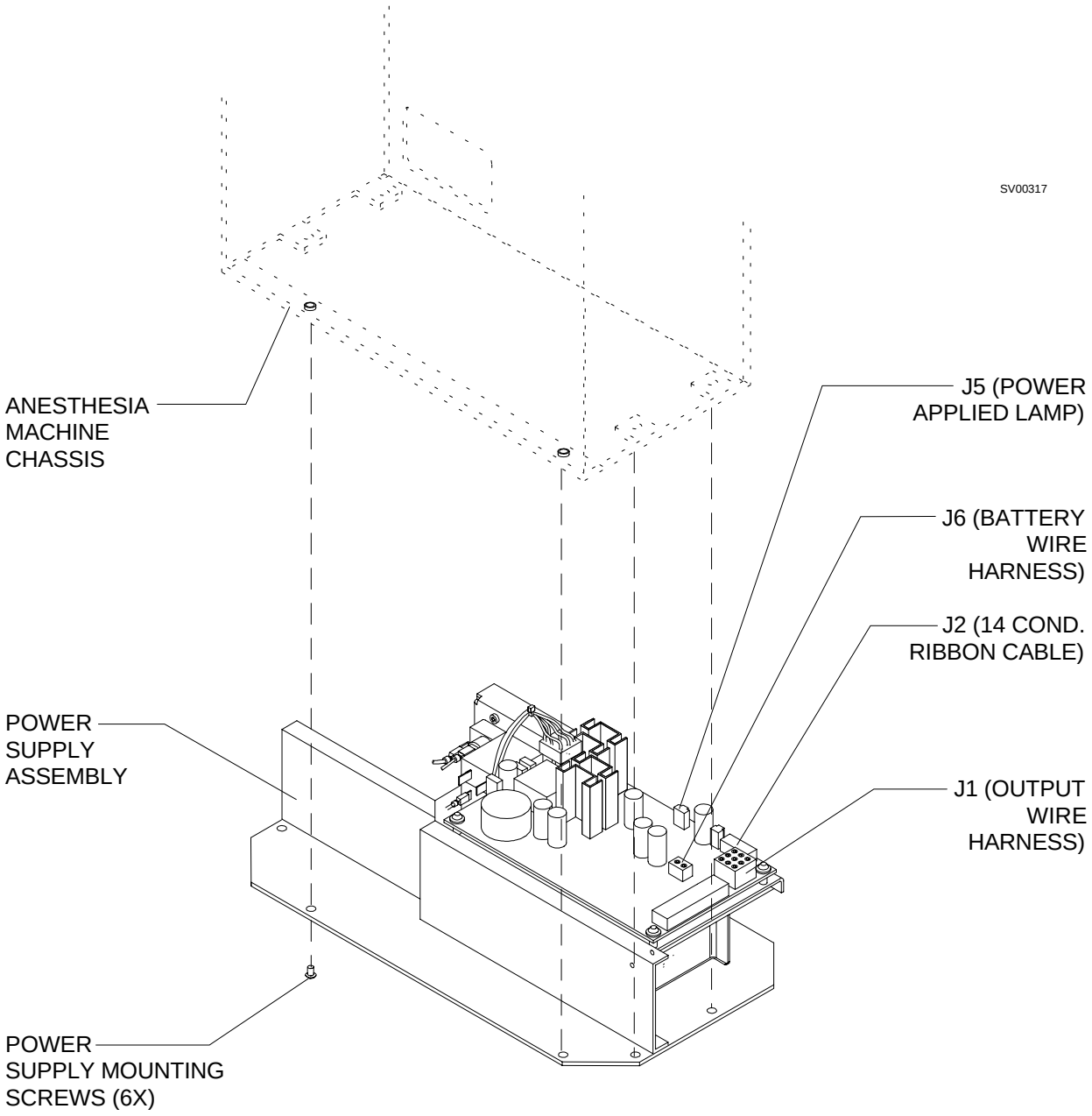


Figure 4-16. Power Supply Assembly Replacement

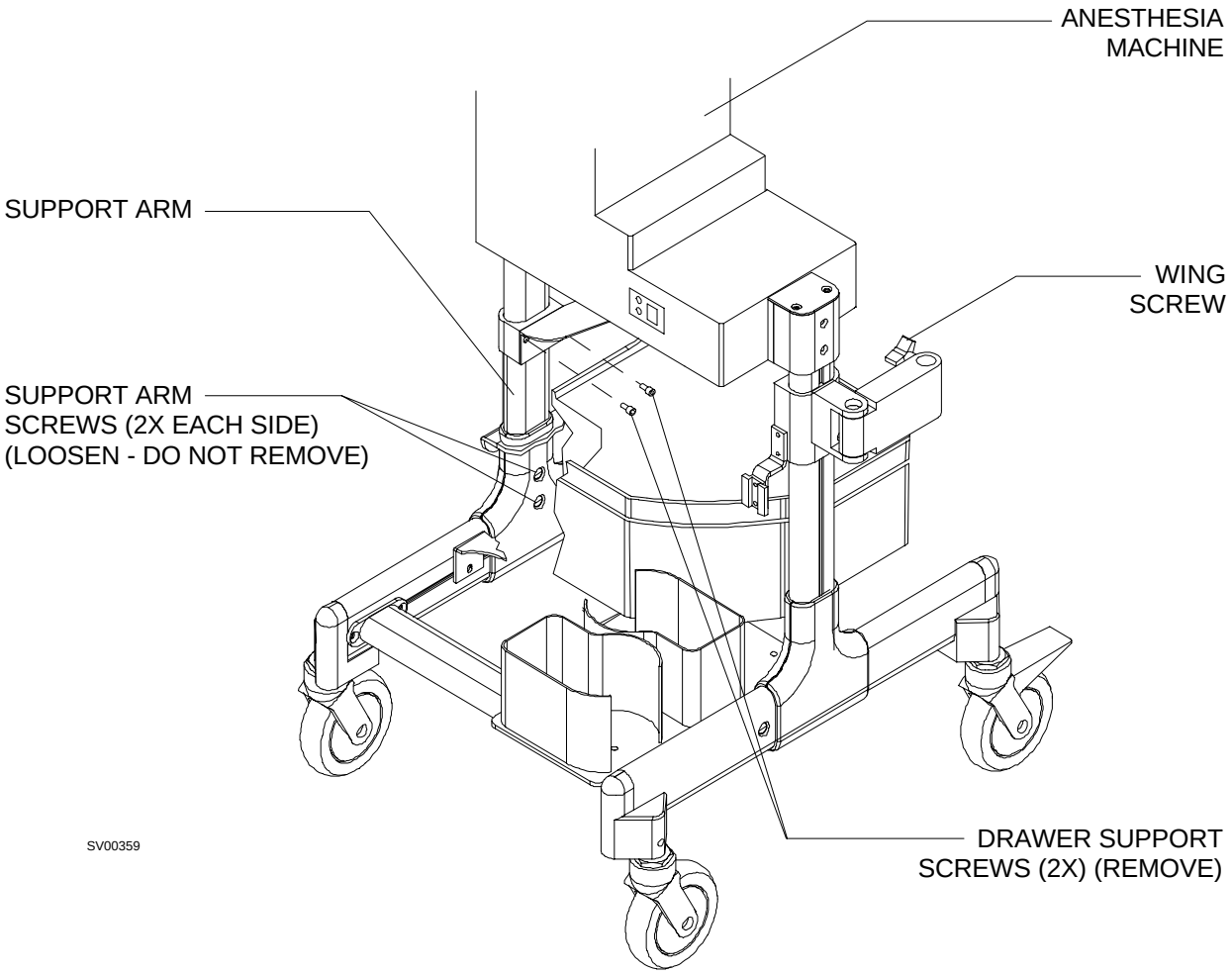


Figure 4-16A. Removal of Machine from Support Frame

4.16.11 Carefully disconnect the following from the PCB on the assembly:

Output wire harness from J1
14 cond. ribbon cable from J2
Battery wire harness from J6
Power applied lamp from J5

4.16.12 Reconnect the cables and wire harnesses to J1, J2, J6, and J5 on the replacement power supply assembly.

4.16.13 Position the power supply assembly in the housing and secure it with the six mounting screws throughthe bottom of the power supply.

4.16.14 Reattach the machine to its support frame as follows:

4.16.14.1 Carefully fit the vertical support arms into the frame; note that the right side arm (facing the front of the machine) must pass through the upper drawer support.

4.16.14.2 Tighten the two support arm screws on each side.

4.16.14.3 Reinstall the two drawer support screws.

4.16.15 Reinstall the display, vaporizer, absorber assembly and cylinders.

4.16.16 Reconnect the fresh gas hose.

4.16.17 Reinstall all accessories that were previously removed; restore all breathing, scavenger and sensor interface connections. Refer to the Installation Instructions in the *Narkomed Mobile Setup and Installation Manual.*

4.16.18 Enable the circuit breakers by pushing in each button.

4.16.19 Reconnect the AC power cord.

4.16.20 Perform the PMS procedure given in Section 6.

4.17 Processor Assembly

Access to the processor assembly requires removal of the top cover from the monitor housing. Figure 4-17 shows the processor mounting arrangement and location of cables that must be disconnected.

4.17.1 Turn the System Power switch to STANDBY and remove AC power from the machine.

4.17.2 Remove the screws securing the top cover of the monitor housing. Lift the cover and disconnect its ground wire.

CAUTION: The processor board contains static sensitive devices. Use ESD protection when handling the processor assembly. Static discharge can damage components on the circuit board.

4.17.3 Disconnect the following items from their connectors on the processor board:

J105: 30 psi switch	J12: Speaker
J4: Keypad cable	J204: Display cable
J102: Spiromed interface	J103: O_2 Sensor interface
J14: Power supply wire harness	J18: Serial port
Tubing connection to breathing pressure transducer	

4.17.4 Remove the screws securing the processor assembly to the monitor housing, and lift out the processor assembly.

4.17.5 Inspect the jumper on JP6 (top PCB) on the replacement processor assembly and ensure it is installed on both pins of JP6 before installing the processor assembly.

NOTE: This jumper is not placed on both pins of JP6 in order to prevent backup battery drain while the processor assembly is in stock.

NOTE: Make sure the configuration jumper is across Pins 1 and 2 of JP101 on the GS personality card. This will configure the software for the ultrasonic flow sensor.

4.17.6 Install the replacement processor using the hardware that was removed in the previous step.

4.17.7 Reconnect the pneumatic tubing and cables that were previously disconnected.

4.17.8 Reconnect the ground wire, and reinstall the monitor housing top cover.

4.17.9 Restore power to the machine and observe the Power-Up Diagnostic display (see Section 2) to verify that the replacement processor is working properly.

4.17.10 Perform the PMS Procedure given in Section 6.

REPLACEMENT PROCEDURES (continued)

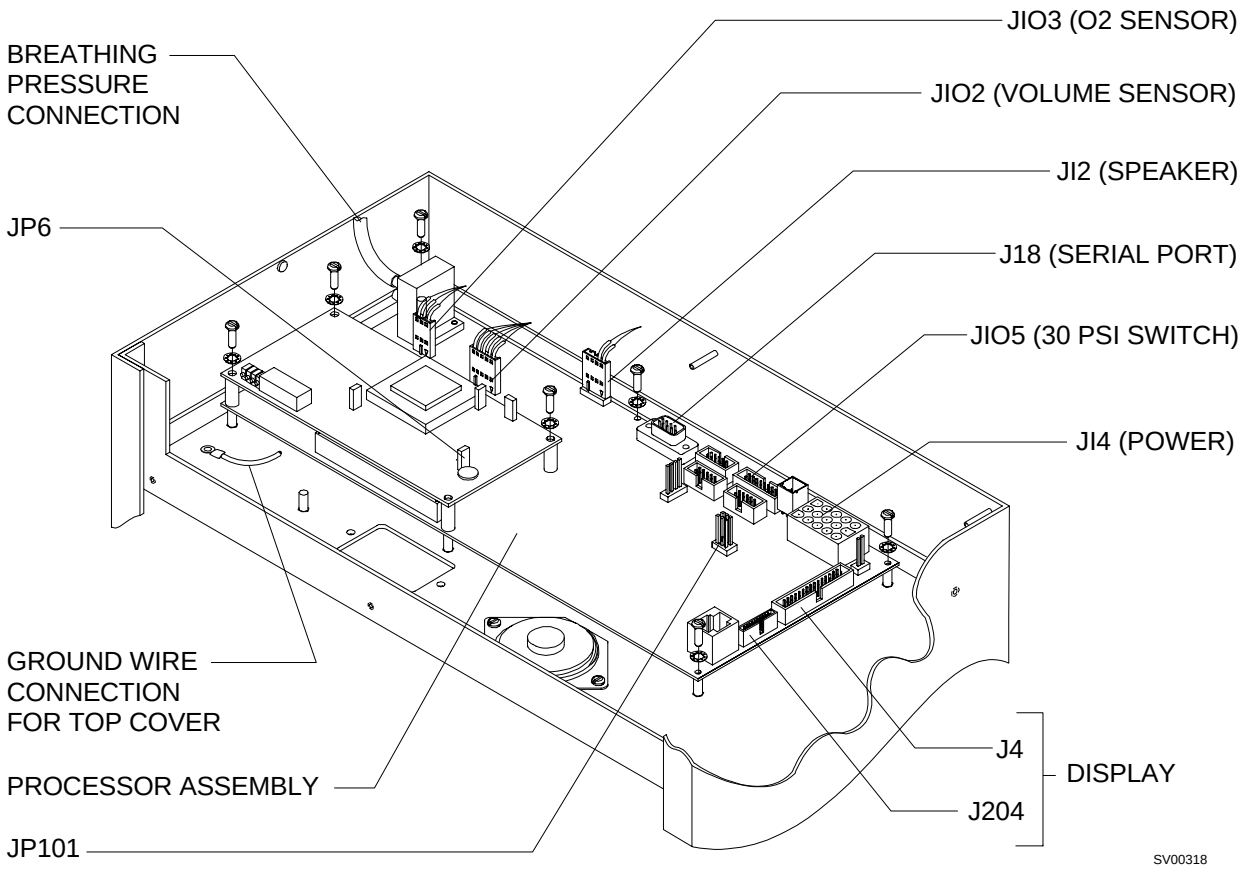


Figure 4-17. Processor Assembly

4.18 Display Assembly

The display assembly comprises the keypad & display panel, its housing, cable, and mounting rod. The display assembly is attached to the joint assembly (remote bar and monitor support arm) by a screw as shown in Figure 4-18.

4.18.1 Turn the System Power switch to STANDBY.

4.18.2 Unplug the display cable from its port on the side of the machine.

4.18.3 Remove the display assembly retainer screw from the joint assembly (support arm) and lift out the display assembly.

4.18.4 Install the replacement display assembly in the support arm; reinstall and tighten the display assembly retainer screw.

4.18.5 Connect the display cable to its port on the side of the machine.

4.18.6 Power up the machine and observe the display for correct operation; exercise all of the keypad functions to verify their operation.

REPLACEMENT PROCEDURES (continued)

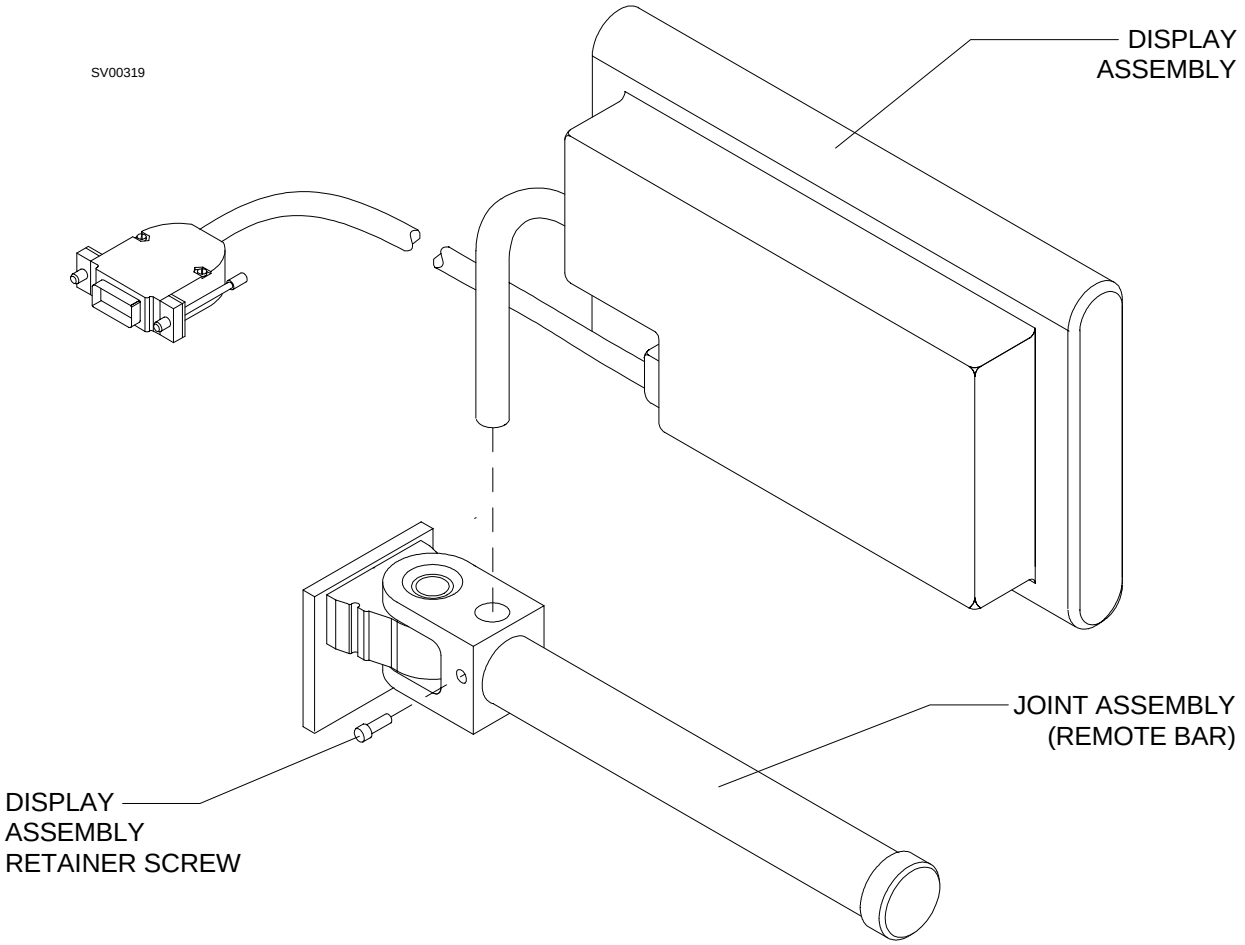


Figure 4-18. Display Assembly

4.19 Breathing Pressure Hose Assembly

The breathing pressure hose assembly consists of a pressure sensor adapter with a hose attached, with a quick-connect fitting at the outboard end of the hose. The hose connects to the breathing pressure interface panel on the monitor housing. The pressure sensor adapter is inserted between the inspiratory valve dome and the oxygen sensor housing as shown in Figure 4-19.

Removal:

4.19.1 Turn the System Power switch to STANDBY.

4.19.2 Disconnect the hose fittings from the interface panel and the absorber.

4.19.3 Pull the oxygen sensor housing from the pressure sensor adapter (it is a press fit).

4.19.4 Pull the pressure sensor adapter from the absorber top dome (it is a press fit).

Installation:

4.19.5 Insert the pressure sensor adapter into the absorber top dome.

4.19.6 Insert the oxygen sensor housing into the pressure sensor adapter.

4.19.7 Connect the short hose to the fitting on the absorber assembly.

4.19.8 Connect the longer hose to the breathing pressure interface panel.

4.19.9 Restore power to the machine and perform the pressure monitor diagnostic test given in Section 2 to verify operation of the system.

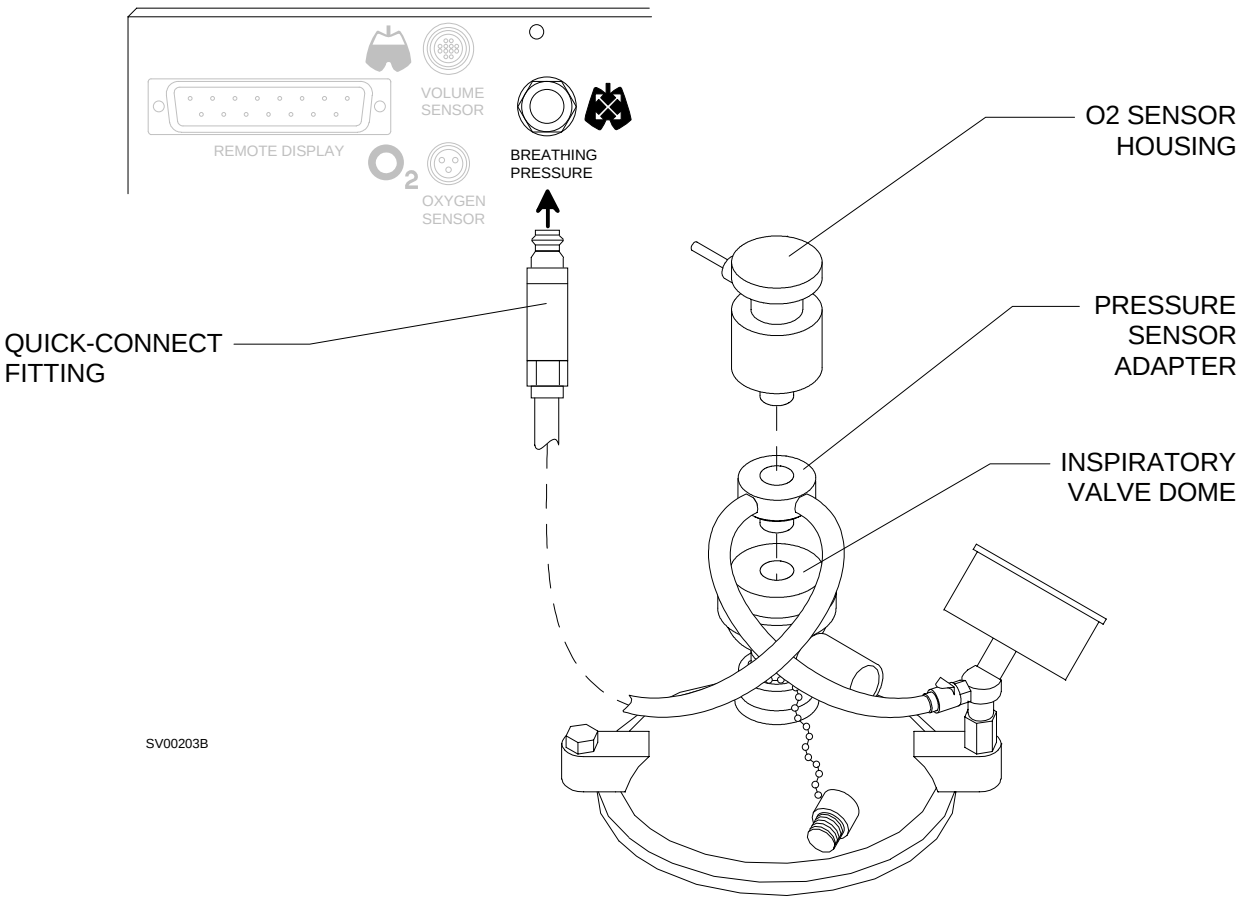


Figure 4-19. Breathing Pressure Hose Assembly

4.20 Manual/Automatic Selector Valve

The manual/automatic selector valve is part of the absorber assembly, and is fixed to the absorber flange with three screws. Figure 4-20 shows the components that are mounted on the valve, and the attaching hardware at the absorber flange.

4.20.1 Turn the System Power switch to STANDBY.

4.20.2 Disconnect the ventilator hose from the rear 22 mm terminal on the selector valve, and remove the terminal.

4.20.3 Disconnect the bag hose from the bottom 22 mm terminal on the selector valve, and remove the terminal.

4.20.4 Disconnect the scavenger hose from the 19 mm terminal on the APL valve.

4.20.5 Loosen the locking ring on the APL valve with a spanner wrench (P/N S010058), and unscrew (counter-clockwise, viewed from the top) the APL valve from the manual/automatic selector valve.

4.20.6 Remove the three screws securing the selector valve to the absorber flange, and remove the valve.

4.20.7 Ensure that the O-ring at the absorber flange is in good condition, and attach the replacement manual/automatic selector valve to the absorber flange using the three screws and lock washers that were previously removed.

4.20.8 Reinstall the APL valve: Ensure that the fiber washer is in place, and screw the valve in to its desired position. Tighten the locking ring with the spanner wrench.

4.20.9 Reinstall the 22 mm hose terminals on the selector valve; ensure that their O-rings are in good condition.

4.20.10 Re-connect the ventilator hose to the rear 22 mm terminal, and re-connect the bag hose to the bottom 22 mm terminal.

4.20.11 Re-connect the scavenger hose to the 19 mm terminal on the APL valve.

4.20.12 Perform the PMS Procedure given in Section 6.

REPLACEMENT PROCEDURES (continued)

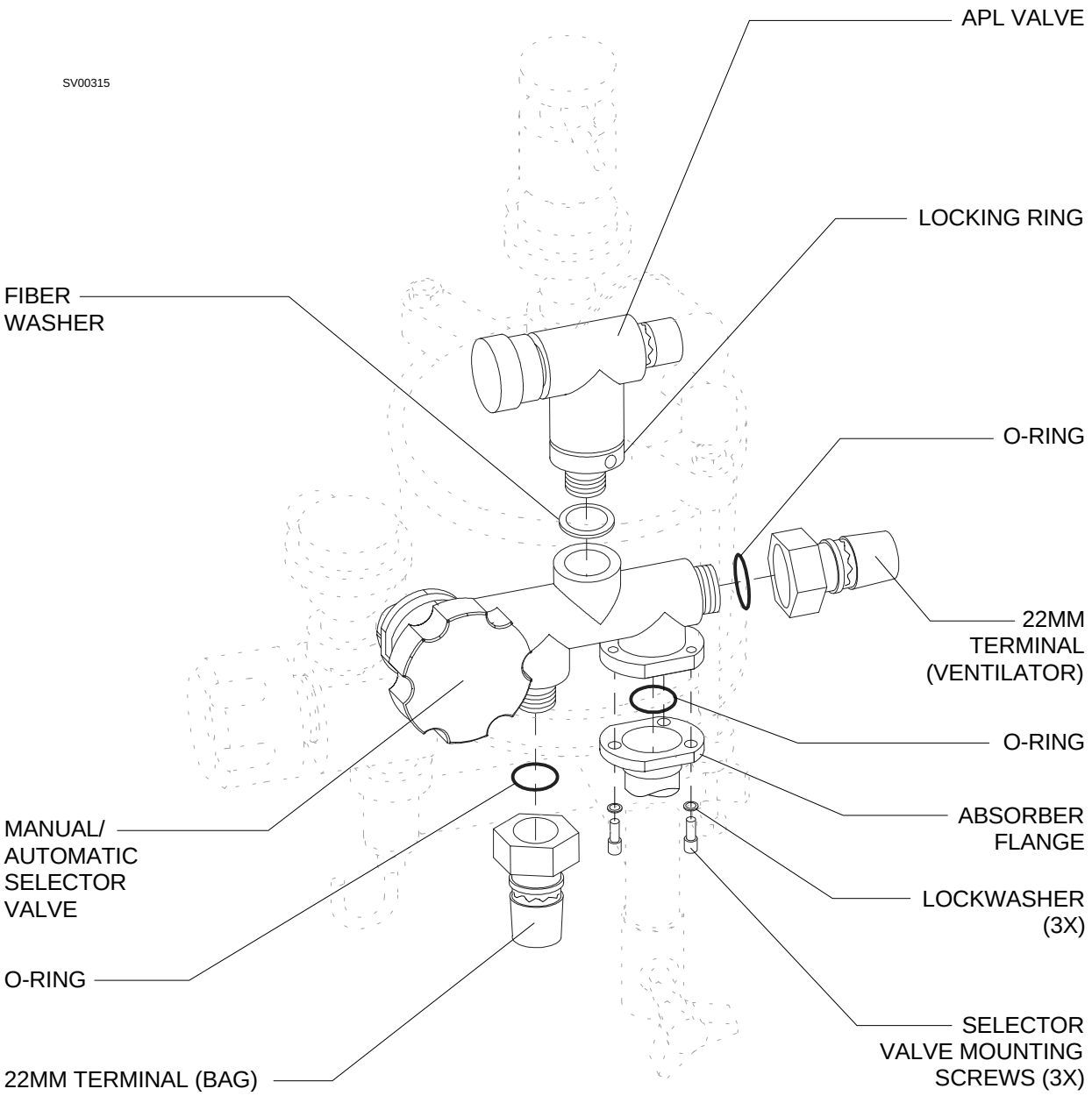


Figure 4-20. Manual/Automatic Selector Valve

4.21 Ultrasonic Flow Sensor

The ultrasonic flow sensor is mounted on a bracket attached to the inspiratory valve mount on the top of the absorber. A short connector hose joins the expiratory valve to the flow sensor. The mounting and connection arrangement is shown in Figure 4-21.

4.21.1 Turn the System Power switch to STANDBY.

4.21.2 Disconnect the sensor plug from the volume sensor interface panel on the monitor housing.

4.21.3 Disconnect the breathing hose from the flow sensor.

4.21.4 Remove the connector hose from the other port of the flow sensor by unscrewing the retaining ring on the hose.

4.21.5 Pull the the flow sensor up and off the mounting bracket

4.21.6 Slide the replacement sensor onto the mounting bracket - oriented in the same manner as the original.

4.21.7 Join the connector hose to the threaded port on the flow sensor, and reconnect the breathing hose to the sensor.

4.21.8 Connect the sensor plug to the volume sensor interface panel on the monitor housing.

4.21.9 Restore power to the machine and perform the respiratory flow monitor calibration procedure given in Section 5.

4.21.10 Perform the PMS Procedure given in Section 6.

REPLACEMENT PROCEDURES (continued)

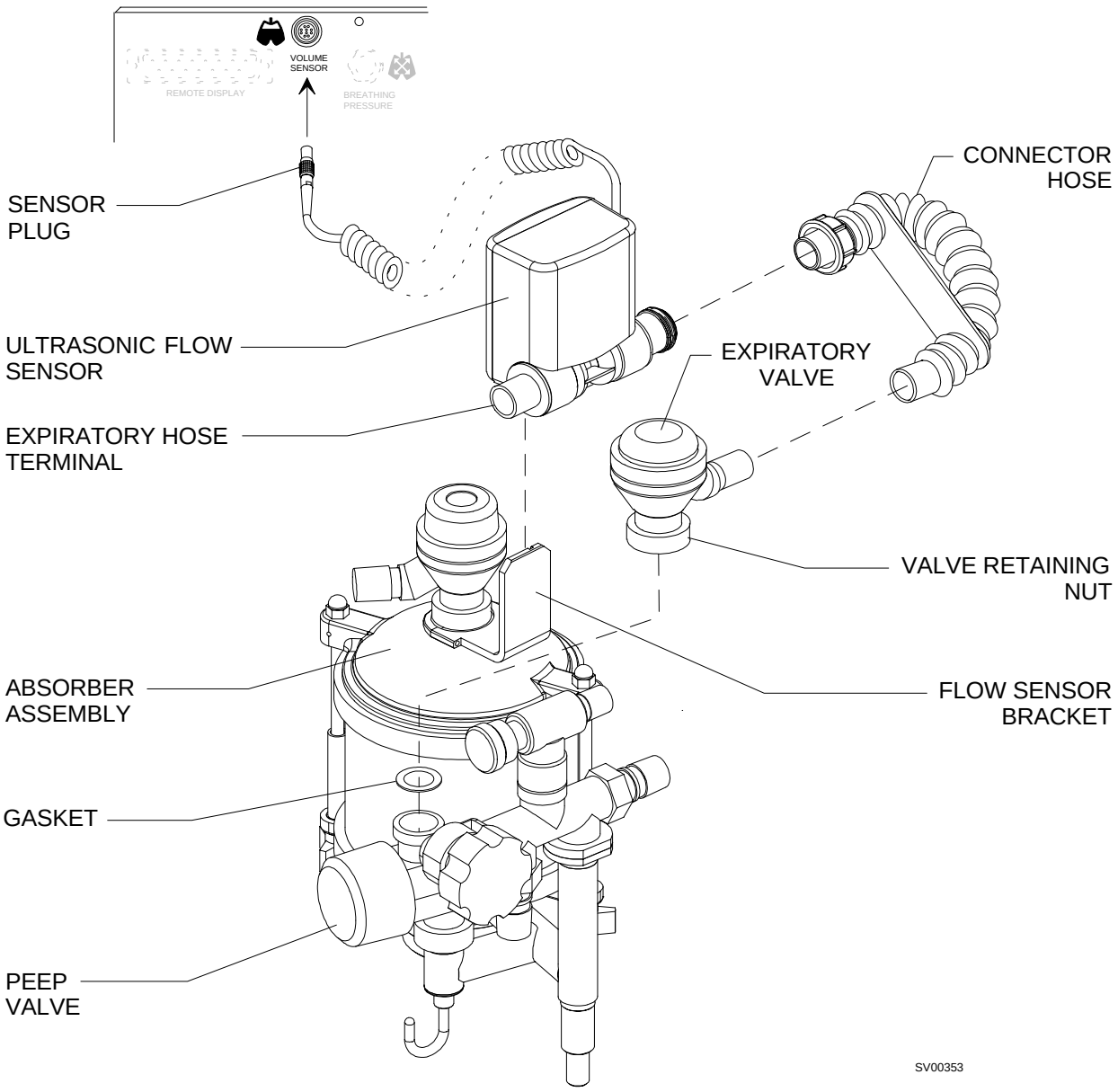


Figure 4-21. Ultrasonic Flow Sensor

4.22 Oxygen Sensor

The oxygen sensor is installed in the pressure sensor adapter on top of the inspiratory valve. Figure 4-22 shows the arrangement of the sensor capsule and its housing, and also its interface cable connection on the side of the monitor housing.

4.22.1 Turn the System Power switch to STANDBY.

4.22.2 Pull the oxygen sensor housing from the oxygen sensor adapter. (It is a press fit.)

4.22.3 Unscrew the cover from the sensor housing and remove the sensor capsule.

4.22.4 Remove the replacement sensor capsule from its shipping container and install it in the housing. Ensure that the copper rings on the capsule mate with the electrical contacts in the sensor housing.

4.22.5 Wait 15 minutes to allow the sensor capsule to stabilize.

4.22.6 Restore power to the machine and perform the Zero and the 21% calibration procedure for the oxygen monitor given in Section 5.

4.22.7 Insert the oxygen sensor assembly into the pressure sensor adapter.

4.22.8 Perform the PMS Procedure given in Section 6.

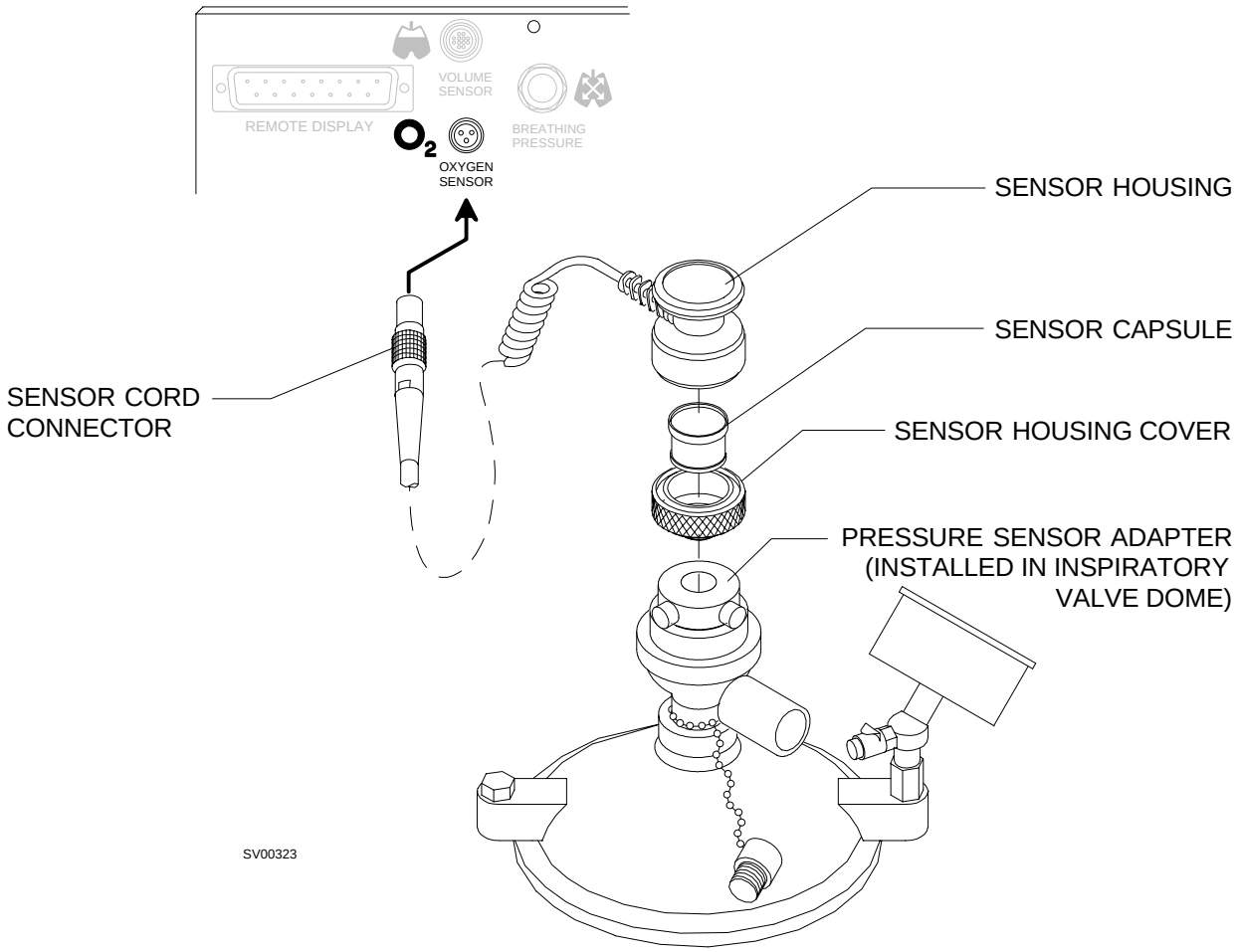


Figure 4-22. Oxygen Sensor

5.0 Adjustment and Calibration Procedures

Equipment Required:

- Test Gauge for setting cylinder pressure regulator, NAD Part No. 4114807
- Oxygen Monitor for adjusting Oxygen Ratio Controller
- Test fixture with breathing pressure line connector, TEE connector, gauge, and inflation device, for breathing pressure monitor calibration

5.1 Cylinder Pressure Regulator Adjustment

5.1.1 Turn the System Power switch to STANDBY.

5.1.2 Remove the flowmeter housing back cover.

NOTE: Figure 5-1 shows test connections for the O_2 regulator adjustment. If you are adjusting the N_2O regulator, connect the test gauge in series with the N_2O pipeline hose.

5.1.3 Connect test pressure gauge (P/N 4114807) between machine's pipeline inlet connector and the pipeline supply hose.

5.1.4 Open the cylinder valves and turn the System Power switch to ON.

5.1.5 Set the oxygen flow to 4 liters per min. (If you are adjusting the N_2O regulator, also set the nitrous oxide flow to 4 liters per minute.)

5.1.6 Depress the push button on the test device.

5.1.7 Release the push button. After the pressure decay stabilizes, the gauge should indicate 46 psi.

5.1.8 Remove the acorn nut on the regulator to expose the adjusting screw. Make an adjustment, then repeat the previous two steps to obtain a reading. Repeat this process until 46 psi is obtained.

5.1.9 Reinstall the acorn nut on the regulator.

5.1.10 Close the cylinder valves and allow pressure to drain from the system.

5.1.11 Close all of the flow control valves and set the System Power switch to STANDBY.

5.1.12 Disconnect the test gauge.

5.1.13 Reinstall the flowmeter housing back cover.

5.1.14 Connect the pipeline hoses.

5.1.15 Perform the PMS Procedure given in Section 6.

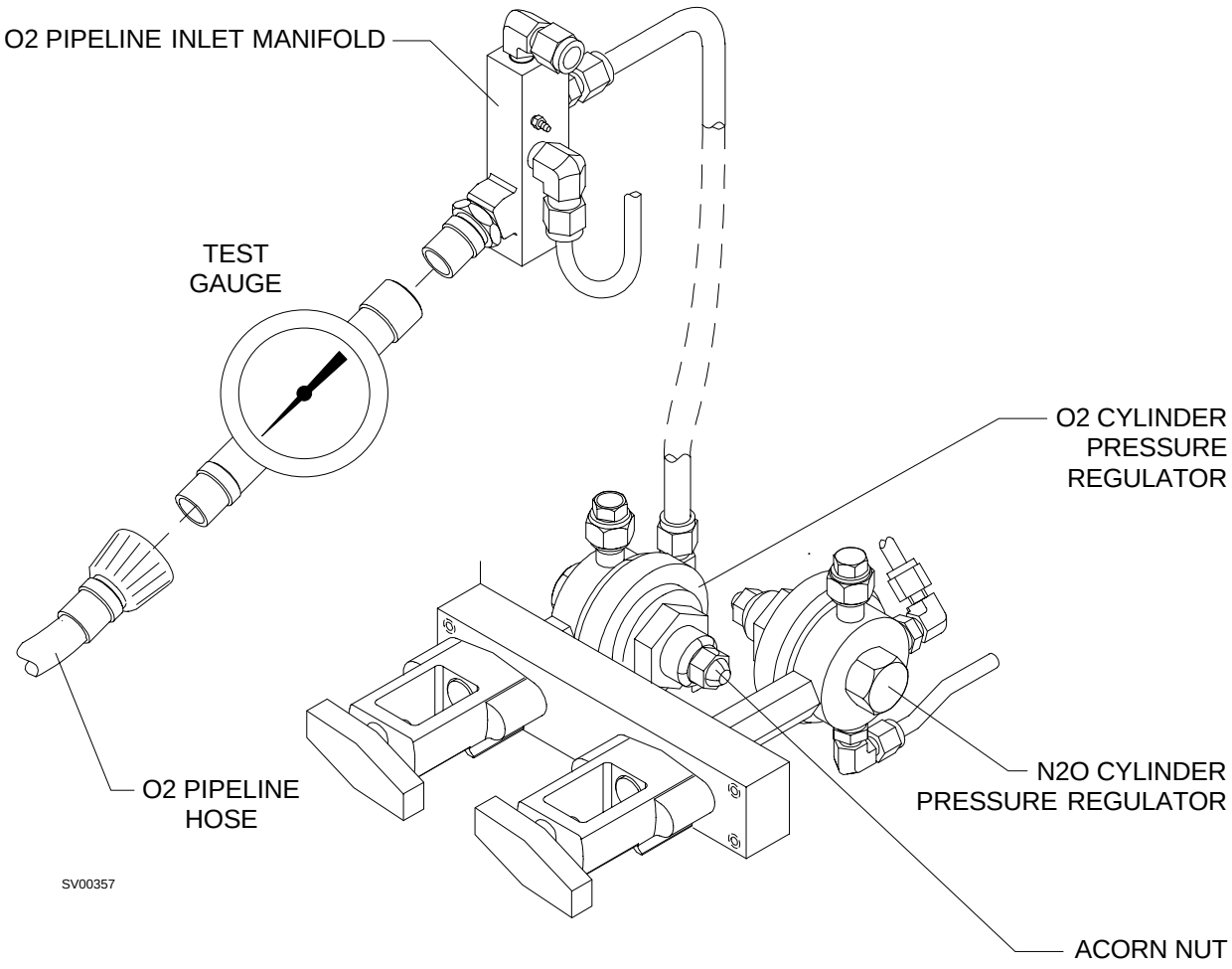


Figure 5-1. Cylinder Pressure Regulator Adjustment

5.2 Oxygen Supply Pressure Alarm Switch Adjustment

5.2.1 Disconnect all pipeline hoses and turn the System Power switch to ON.

5.2.2 Open the oxygen cylinder valve.

5.2.3 Set the oxygen flow to 5 liters per min.

5.2.4 Open the other gas flow control valves to drain pressure from the system.

5.2.5 Close the O_2 cylinder valve, and close the flow control valves. Press the O_2 Flush valve to drain oxygen pressure from the system.

5.2.6 Turn the System Power switch to STANDBY.

5.2.7 Remove the rear cover from the flowmeter housing.

5.2.8 Connect test pressure gauge (P/N 4114807) between machine's oxygen pipeline inlet connector and the oxygen pipeline supply hose.

5.2.9 Open the O_2 cylinder valve and turn the System Power switch to ON.

5.2.10 Set the oxygen flow to 200 mL per min.

5.2.11 Close the oxygen cylinder valve.

5.2.12 As the pressure drops, the O_2 SUPPLY alarm should activate when the pressure is between 40 and 34 psi as shown on the test gauge.

5.2.13 If the alarm activates when the pressure is below 34 psi or above 40 psi, turn the adjustment set screw (see illustration); repeat the test and adjust as necessary to bring the set point into the correct range.

5.2.14 Turn the System Power switch to STANDBY.

5.2.15 Disconnect the test gauge.

5.2.16 Reinstall the rear cover and its retaining screws.

5.2.17 Connect the pipeline hoses.

5.2.18 Perform the PMS Procedure given in Section 6.

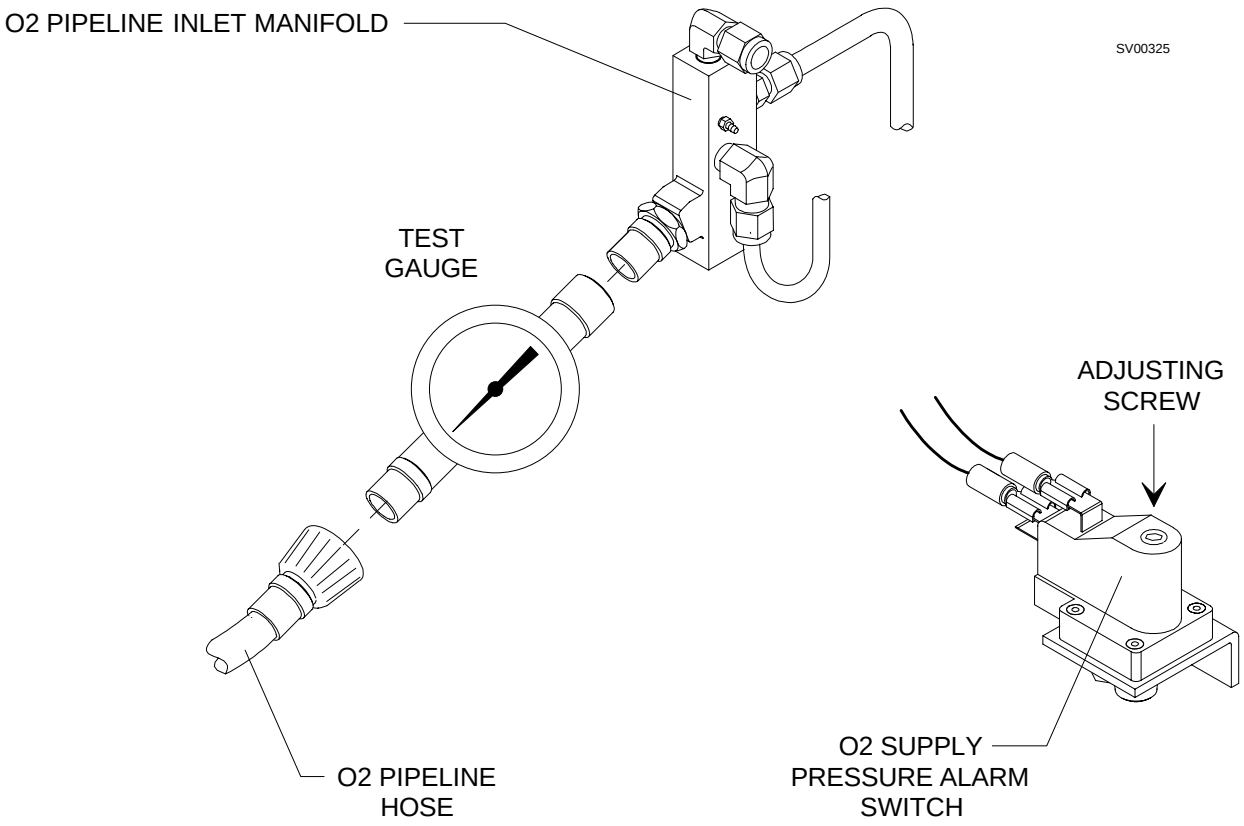


Figure 5-2. Oxygen Supply Pressure Alarm Switch Adjustment

5.3 Oxygen Ratio Controller (ORC) Adjustment

5.3.1 Remove the rear cover of the flowmeter housing.

5.3.2 Connect a calibrated oxygen monitor to the fresh gas outlet.

5.3.3 Connect the pipeline hoses.

5.3.4 Turn the System Power switch to ON.

5.3.5 Set the O_2 flow to 8 l/min.

5.3.6 Set the N_2O flow to 8 l/min.

5.3.7 Set the O_2 flow to 800 ml/min for one (1) minute. Verify that the O_2 concentration is between 21% and 29% (N_2O flow of 2.7 to 3.0 l/min.). If needed, loosen the locknut on the ORC and turn the adjusting screw (counter-clockwise to decrease N_2O flow, clockwise to increase N_2O flow) to achieve a nominal O_2 concentration of 25%.

5.3.8 Repeat the previous three steps until no further adjustment is needed. Tighten the locknut.

5.3.9 Adjust the oxygen flow to a point where the nitrous oxide flowmeter indicates 8 l/min.

5.3.10 Verify that the O_2 concentration is between 21% and 29% (O_2 flow of 2.1 to 3.3 l/min.).

5.3.11 Slowly decrease the oxygen flow to 800 l/min. The nitrous oxide flow should decrease proportionally, and the O_2 concentration should remain between 21% and 29%.

5.3.12 Close the O_2 flow control valve, and fully open the N_2O flow control valve. Verify that the O_2 concentration is between 22% and 31%.

5.3.13 Close the N_2O flow control valve and turn the System Power switch to STANDBY.

5.3.14 Replace the flowmeter housing rear cover.

5.3.15 Perform the PMS Procedure given in Section 6.

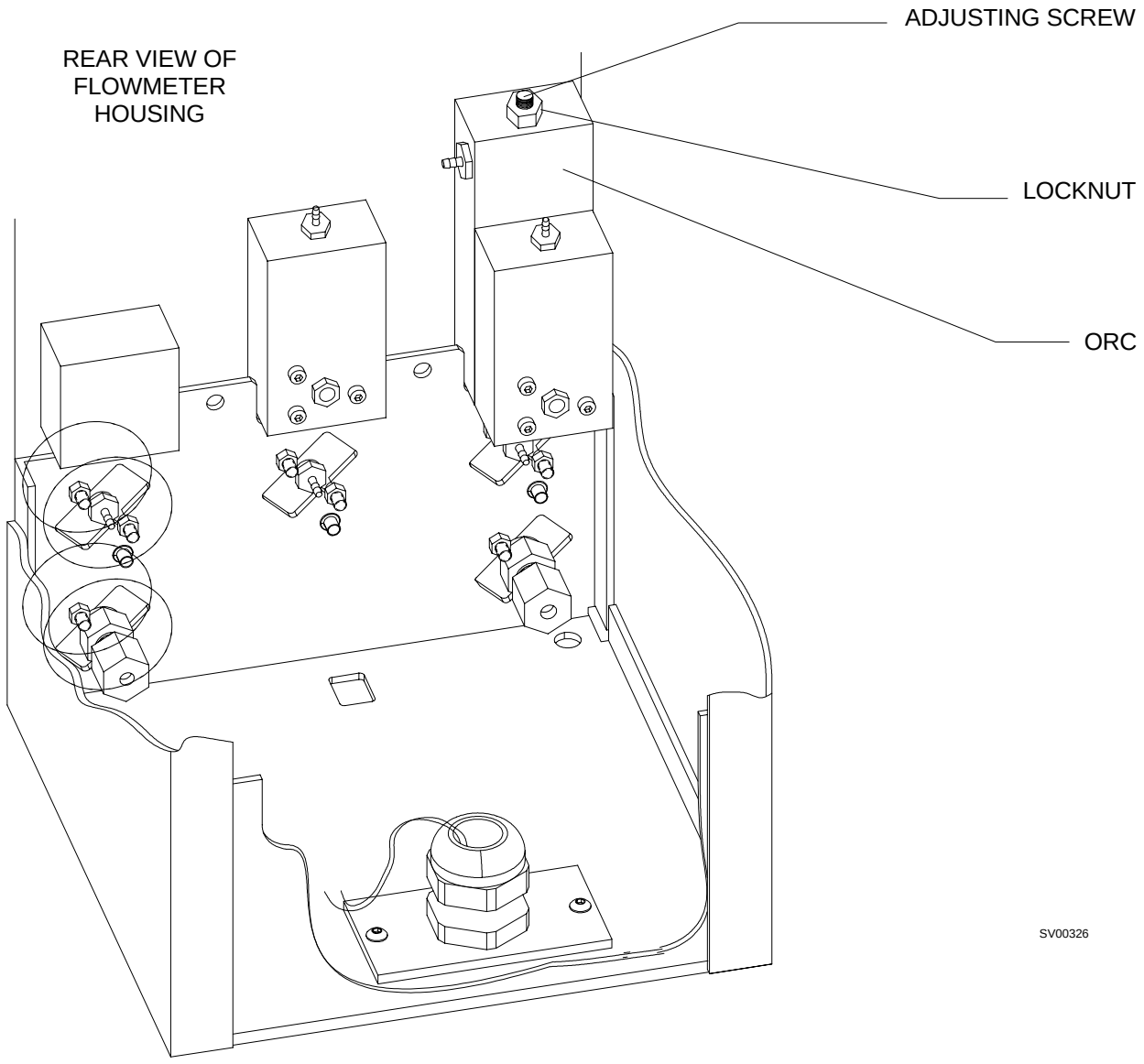


Figure 5-3. Oxygen Ratio Controller (ORC) Adjustment

5.4 Oxygen Sensor Calibration

5.4.1 Turn the System Power switch to ON.

5.4.2 Enter the Main Service Screen and select the Service Mode (ref. Section 2).

5.4.3 Enter the Oxygen Monitor Service Screen.

5.4.4 Zero Calibration

5.4.4.1 Remove the oxygen sensor capsule from its housing and allow several minutes for the displayed offset readings to stabilize.

NOTE: The difference between the displayed CELL A and CELL B readings should be no greater than 8.

5.4.4.2 Press the key next to ZERO to store the current values as the new zero calibration.

5.4.4.3 Reinstall the sensor capsule in its housing.

5.4.5 21% Calibration

5.4.5.1 Expose the sensor to ambient air only (away from any open part of the breathing system) and allow it to stabilize for several minutes.

5.4.5.2 Press the key next to EXIT to return to the Main Service Screen. Press the key next to EXIT again to return the display to normal operation.

5.4.5.3 Press the CAL key to initiate the 21% O_2 calibration.

During calibration, the LED next to the CAL key lights, and the label CAL appears in the oxygen monitor window. Following successful calibration, the currently sensed oxygen concentration appears in the oxygen monitor window.

5.4.5.4 When calibration is complete, reinstall the sensor assembly in the inspiratory valve dome.

NOTE: If the O_2 sensor will not calibrate properly, refer to the Oxygen Monitoring section of the *Narkomed Mobile OPERATOR'S INSTRUCTION MANUAL* for further information.

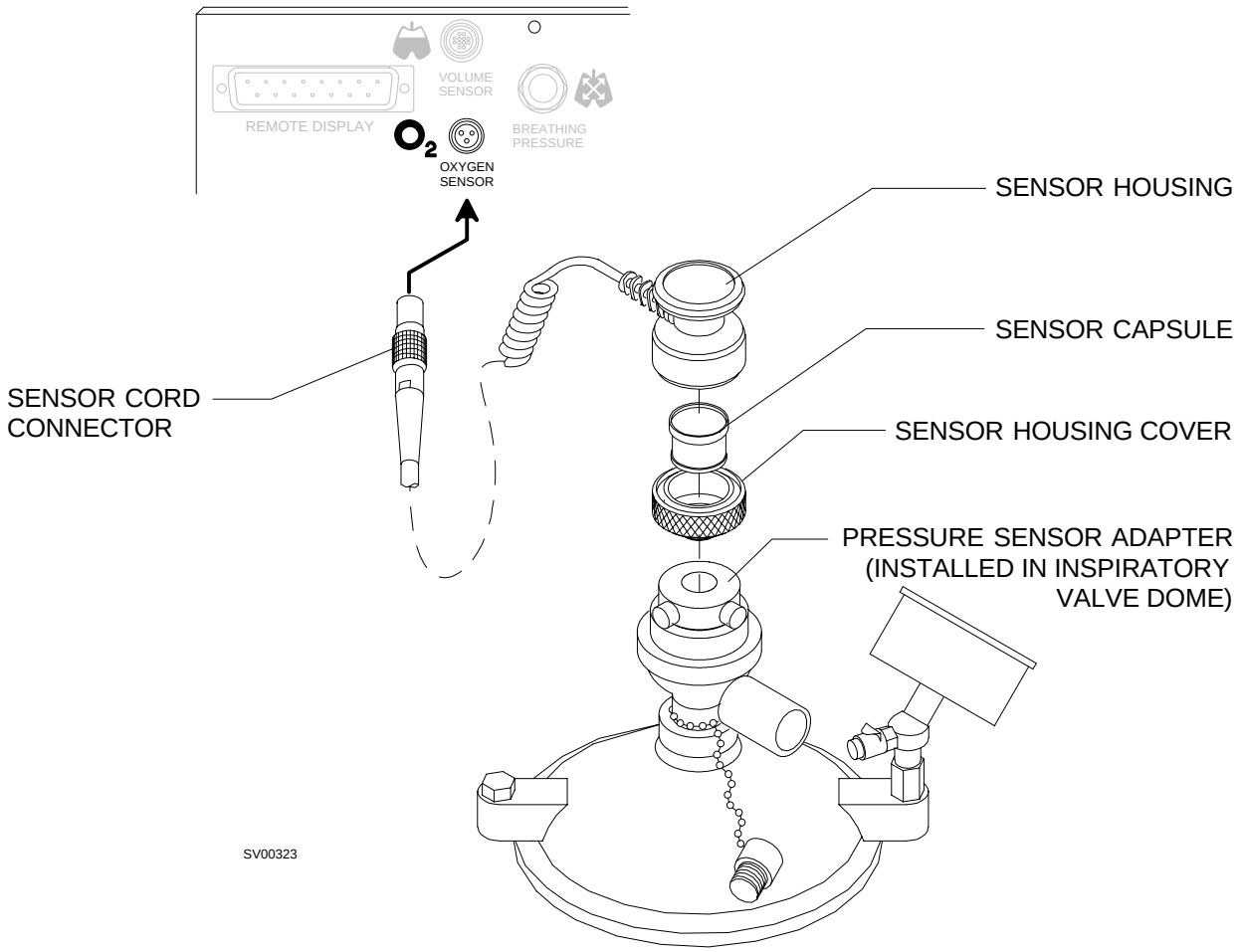


Figure 5-4. Oxygen Sensor Calibration

5.5 Breathing Pressure Monitor Calibration

5.5.1 Turn the System Power switch to ON.

5.5.2 Enter the Main Service Screen and select the Service Mode (ref. Section 2).

5.5.3 Proceed to the Pressure Monitor Service Screen.

5.5.4 Zero Calibration

5.5.4.1 Disconnect the breathing pressure hose from the interface panel on the monitor housing, and let the current pressure value stabilize.

5.5.4.2 Press the key next to ZERO to store the current value as the new zero.

5.5.5 Span Calibration

5.5.5.1 With a test fixture connected as shown in Figure 5-5, apply a pressure of 50 cm H_2O to the breathing pressure interface panel.

5.5.5.2 When the displayed current value is stabilized, press the key next to SPAN to store the current value as the new span calibration.

5.5.6 Disconnect the test fixture; reconnect the breathing pressure hose to the interface panel.

5.5.7 Press the key next to EXIT to return to the Main Service Screen.

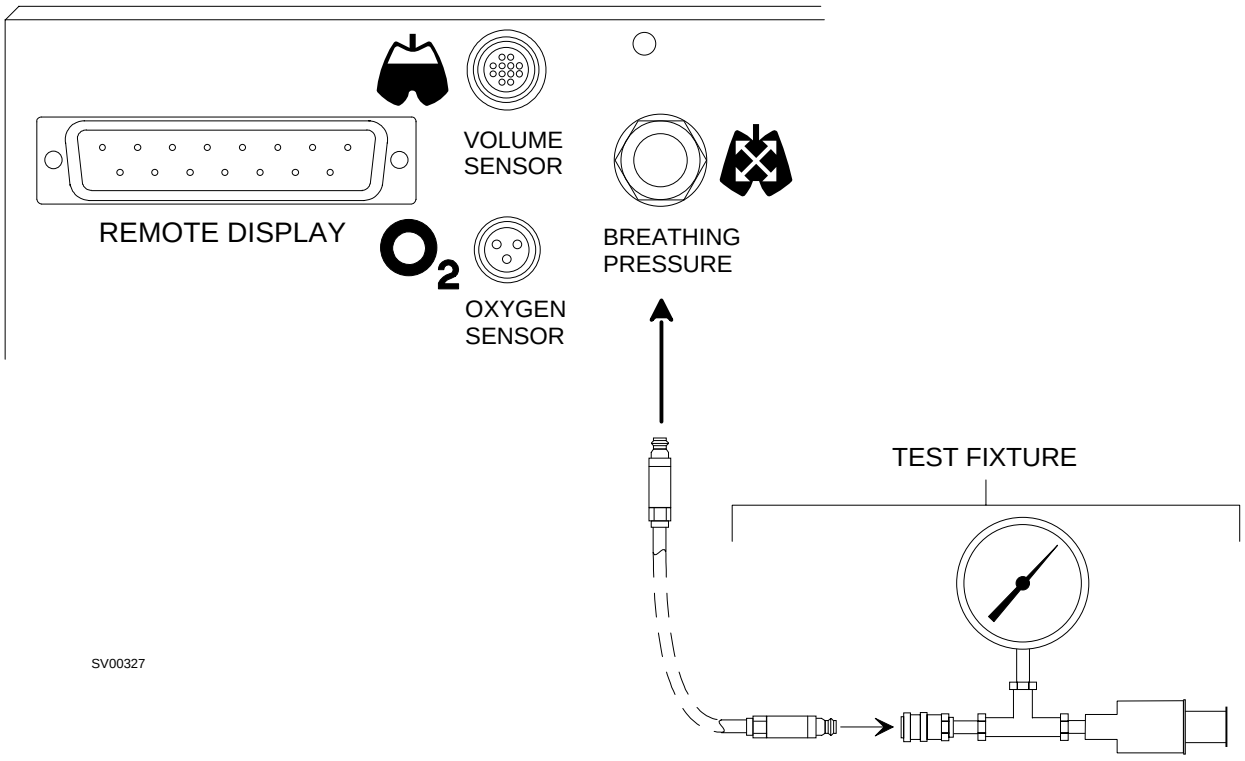


Figure 5-5. Pressure Monitor Calibration

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6.0 PMS Procedure, Narkomed Mobile

The procedures in this section shall be performed in their entirety each time a component is removed, replaced, calibrated, adjusted and during all scheduled Periodic Manufacturer's Service (PMS) visits. A PMS Checklist form, available from the North American Dräger Technical Service Department, shall be completed by the Technical Service Representative each time a PMS is performed. The section numbers on the PMS checklist form are keyed to paragraph numbers in this manual. Steps in the procedure marked with (✓) require a response at the corresponding line on the checklist form.

Space is also provided on the PMS checklist form to record the results of a vapor concentration test. Contact the North American Dräger Technical Service Department for vapor concentration verification procedures.

NOTE: Verify the dates on test equipment calibration labels. DO NOT USE any test equipment having an expired calibration date.

Test Equipment Required:

- Multi-Meter (Fluke or Equivalent)
- Electrical Safety Analyzer (Biotek 501 Pro or Equivalent)
- Test Pressure Gauge, P/N 4114807
- Fresh Gas Outlet Volume Test Device, P/N S010158
- Fresh Gas Leak Test Device, P/N 4113119
- Adapter Assembly, Test Terminal, P/N 4104389
- Flowmeter Test Stand, P/N S000081
- Breathing System Leak Test Device, P/N S010159
- Tube, Corrugated, 22 mm x 12 in. long, P/N 9995112
- Breathing Bag, 3 liter, P/N 9995330
- Baromed Pressure Test Fixture
- Test Minute Volume Meter, P/N 2212300 (or Equivalent)
- Digital Pressure Manometer (SenSym PDM 200CD or Equivalent)
- Riken Gas Indicator, Model 18
- Stop Watch
- Adapter assembly, fresh gas O_2 P/N 4110425

PMS PROCEDURE (continued)

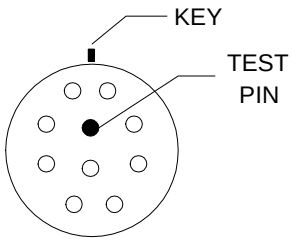
6.1 Safety Testing

(✔) 6.1.1 Circuit Isolation Test

6.1.1.1 Turn the System Power switch to STANDBY, remove the AC power cord from the outlet and disable the circuit breakers.

6.1.1.2 Disconnect the respiratory volume sensor cord from the volume sensor receptacle.

6.1.1.3 With a multimeter set to its highest resistance range, check for continuity between the monitor chassis and the circuit common at the sensor interface connector test pin shown in the illustration. there shall be no continuity between these points.



6.1.1.4 Reinstall the AC power cord and enable the circuit breakers.

(✔) 6.1.2 Protective Ground Continuity Test

NOTE: Do not plug the safety analyzer into a line isolation monitor as inaccurate readings may occur.

6.1.2.1 Plug in the safety analyzer; set the safety analyzer function switch to the GROUND WIRE RESISTANCE position. Attach the test lead to the SINGLE LEAD connector of the analyzer.

6.1.2.2 Set the safety analyzer GROUND and NEUTRAL switches to the Normal position. Set the POLARITY switch to the Normal or Off position.

6.1.2.3 Plug the power cord into the AC test receptacle on the safety analyzer. The safety analyzer shall indicate 0.1 ohm or less with its test lead applied to the following points:

- Cylinder yoke
- Monitor housing chassis

6.1.3 Chassis Leakage Current Test

6.1.3.1 Set the safety analyzer to the CHASSIS LEAKAGE CURRENT position, and turn the System Power switch to ON.

6.1.3.2 Attach the safety analyzer test lead to a yoke assembly.

6.1.3.3 Record the total leakage current with normal neutral, and the polarity and ground switches set to the following positions:

NOTE: Turn the System Power switch to STANDBY before changing the polarity switch on the safety analyzer, then return the System Power switch to ON.

	Ground	Polarity
(✔)	Open	Normal
(✔)	Normal	Normal
(✔)	Open	Reversed
(✔)	Normal	Reversed

Verify that the leakage current is 300 microamps or less.

(✔) **6.2 Self-Diagnostics**

6.2.1 Connect the pipeline supply or open the cylinder valve.

6.2.2 Turn the System Power switch to ON.

6.2.3 Verify that the following is shown on the display:

FIRMWARE	PASS	NARKOMED M
RAM	PASS	COPYRIGHT 1997, NAD, INC.
VIDEO	PASS	VERSION X.XX SW
A/D CONVERTER	PASS	SOFTWARE ID. XXXX
AUDIO - PRIMARY	PASS	
- BACKUP	PASS	
SERIAL I/O	PASS	
CLOCK	PASS	
NON-VOLATILE MEMORY	PASS	

FUNCTIONAL

PMS PROCEDURE (continued)

(✔) **6.3 Battery Circuit Test**

6.3.1 Is "ON" LED lighted? __ (Y)

6.3.2 With the System Power switch ON, unplug the AC power cord.

6.3.3 Does the "AC POWER FAIL" message appear on the display? __ (Y)

6.3.4 Press and hold the "BATTERY TEST" button.

6.3.5 Is green Battery Test LED lighted as long as "BATTERY TEST" button is depressed? __ (Y)

6.3.6 Release the "BATTERY TEST" button.

6.3.7 Restore AC power to the machine.

6.3.8 Does the "AC POWER FAIL" message disappear and the LED extinguish?

(✔) **6.4 Configuration**

6.4.1 Press the CONFIG key.

6.4.2 The CONFIGURE Screen is displayed.

6.4.3 Verify the correct Time and Date.

6.4.4 Adjust the Volume to the highest number.

6.5 Service Screen

6.5.1 Press and hold the Oxygen High Limit key and the Volume Low Limit key, and then press the [▲] key.

6.5.2 The Main Service Screen appears.

(✔) 6.5.3 Record the Last Service Date on the PMS form.

(✔) 6.5.4 Record the Hours Run Since Last Service on the PMS form.

(✔) 6.5.5 Record the Total Hours Run on the PMS form.

6.5.6 Select and enter the Service Log.

6.5.7 Verify any pertinent information from the Service Log. Contact the North American Dräger Technical Service Department if necessary.

6.5.8 Press EXIT to return to the Main Service screen.

6.5.9 Press EXIT to return to normal operation.

6.6 High Pressure Leak Test

(✔) 6.6.1 Yokes & Check Valves

6.6.1.1 Turn the System Power switch to STANDBY.

6.6.1.2 Disconnect the pipeline supplies and close the cylinder valves.

6.6.1.3 Remove cylinder or yoke plug from each yoke assembly.

6.6.1.4 Do the yoke handles adjust smoothly? ___ (Y)

6.6.1.5 Are the two (2) yoke pins installed securely in each yoke? ___ (Y)

6.6.1.6 Is there only one (1) cylinder washer on each yoke assembly? ___ (Y)

6.6.1.7 Is there a yoke plug attached to each yoke assembly? ___ (Y)

6.6.1.8 Is the proper gas I.D. label affixed to each yoke assembly? ___ (Y)

6.6.1.9 Attach a cylinder to each yoke assembly, open the cylinder valve, let the pressure stabilize, close the cylinder valve, and remove the cylinder from the yoke assembly.

6.6.1.10 Does the yoke check valve assembly prevent the escape of excessive pressure? ___ (Y)

6.6.1.11 Attach the cylinders to the yokes.

PMS PROCEDURE (continued)

6.6.2 Oxygen High Pressure Leak Test

6.6.2.1 Disconnect the pipeline supplies.

6.6.2.2 Turn the System Power switch to STANDBY.

6.6.2.3 Open the oxygen cylinder valve.

6.6.2.4 Let the pressure stabilize.

6.6.2.5 Close the oxygen cylinder valve and remove the cylinder.

6.6.2.6 Observe the oxygen cylinder pressure gauge.

(✔) 6.6.2.7 After two (2) minutes, what is the pressure loss? ___ PSI (<50)

6.6.2.8 Attach the cylinder.

6.6.3 Nitrous Oxide High Pressure Leak

6.6.3.1 Turn the System Power switch to ON.

6.6.3.2 Open one (1) oxygen cylinder valve and one (1) nitrous oxide cylinder valve.

6.6.3.3 Adjust the oxygen flow to 4 L/min.

6.6.3.4 Let the pressure stabilize.

6.6.3.5 Close the nitrous oxide cylinder valve and remove the cylinder.

6.6.3.6 Observe the nitrous oxide cylinder pressure gauge.

(✔) 6.6.3.7 After two (2) minutes, what is the pressure loss? ___ psi (<50)

6.6.3.8 Attach the cylinder.

6.6.3.9 Close the oxygen flow control valve.

6.7 High Pressure Regulator Test

6.7.1 N_2O Regulator

6.7.1.1 Configure the test gauge using a female N_2O DISS connector on the hose and male N_2O DISS connector on the valve body side.

6.7.1.2 Connect the test fixture hose to the machine's nitrous oxide pipeline inlet.

6.7.1.3 Does the back panel correctly identify the nitrous oxide inlet? ___(Y)

6.7.1.4 Connect the nitrous oxide pipeline supply hose to the test fixture.

6.7.1.5 Open the nitrous oxide and the oxygen cylinder valves.

6.7.1.6 Set the oxygen and nitrous oxide flows to 4 L/min.

6.7.1.7 Depress the push button on the test device.

(✔) 6.7.1.8 Release the push button. After the pressure decay stabilizes, what is the regulator output pressure? ___psi (40-49)

NOTE: If a pressure decrease does not occur, either the hospital's supply pressure is too low or the regulator pressure is set too high.

6.7.2 O_2 Regulator

6.7.2.1 Configure a test gauge using a female O_2 DISS connector on the hose and a male O_2 DISS connector on the valve body side.

6.7.2.2 Connect the test fixture hose to the machine's oxygen pipeline inlet.

6.7.2.3 Connect the oxygen pipeline supply hose to the test fixture.

6.7.2.4 Does the back panel correctly identify the oxygen inlet? ___(Y)

6.7.2.5 Set the oxygen flow to 4 L/min.

6.7.2.6 Depress the push button on the test device.

(✔) 6.7.2.7 Release the push button. After the pressure decay stabilizes, what is the regulator output pressure? ___psi (43-49)

PMS PROCEDURE (continued)

6.8 Gauges

(✔) 6.8.1 Cylinder Gauges

6.8.1.1 Bleed all pressure from the cylinder circuit.

6.8.1.2 Is the cylinder gauges at zero (0) PSI? ___ (Y)

6.8.1.3 Open the cylinder valves.

6.8.1.4 Do the cylinder pressure gauges respond properly? ___ (Y)

(✔) 6.8.2 Pipeline Gauges

6.8.2.1 Are the gauges below the flowmeters for pipeline supply pressure? ___ (Y)

6.8.2.2 Are the pipeline pressure gauges at zero (0) PSI? ___ (Y)

6.8.2.3 Connect the pipeline supply.

6.8.2.4 Do the pipeline pressure gauges respond properly? ___ (Y)

6.8.2.5 Are the correct gas identification labels affixed at each of the pipeline inlets? ___ (Y)

6.8.2.6 Does the back panel identify each of the pipeline inlets properly? ___ (Y)

6.9 Oxygen Supply Failure Protection

6.9.1 Nitrous Oxide O.F.P. Device

6.9.1.1 Disconnect the O_2 pipeline supply.

6.9.1.2 Connect the N_2O pipeline supply.

6.9.1.3 Open and close the oxygen cylinder valve.

6.9.1.4 Set the O_2 and N_2O flows to 4 L/min.

(✔) 6.9.1.5 Does the flow of nitrous oxide cease when the oxygen pressure is depleted? ___ (Y)

6.9.1.6 Connect the O_2 pipeline supply.

6.9.1.7 Disconnect the O_2 pipeline supply.

(✔) 6.9.1.8 Does the flow of nitrous oxide cease when the oxygen pressure is depleted? ___ (Y)

6.9.1.9 Close the nitrous oxide flow control valve.

6.9.2 Air O.F.P. Device

6.9.2.1 Open the oxygen cylinder valve.

6.9.2.2 Set the air flow to 4 l/min; set the oxygen flow to 4 l/min.

6.9.2.3 Close the oxygen cylinder valve.

(✔) 6.9.2.4 Does the flow of air cease when the oxygen pressure is depleted? ___ (Y)

6.9.2.5 Close the air flow control valve.

6.9.2.6 Close the oxygen flow control valve.

PMS PROCEDURE (continued)

6.9.3 Oxygen Supply Pressure Alarm

6.9.3.1 If not already connected, connect a test pressure gauge between the machine's oxygen pipeline inlet connector and the oxygen supply pipeline hose.

6.9.3.2 Depress and hold the test device push button.

6.9.3.3 Verify that minimum O_2 flow is present.

6.9.3.4 Release the test device push button.

(✔) 6.9.3.5 What is the pressure on the test pressure gauge when the O_2 SUPPLY PRESSURE message appears? ___ PSI (34-40)

6.9.3.6 Does the O_2 SUPPLY LOW message appear as a Caution? ___ (Y)

6.9.3.7 Remove the test gauge.

6.10 Flowmeter Test

(✔) 6.10.1 Oxygen Flowmeter Test

6.10.1.1 Open the O_2 cylinder valve.

6.10.1.2 Is it possible to adjust the flow of oxygen over the full range of the flowmeters? ___ (Y)

6.10.1.3 Close the O_2 cylinder valve and bleed the pressure.

6.10.1.4 Connect the O_2 pipeline supply.

6.10.1.5 Is the correct flow control knob and label attached to the oxygen flow control valve? ___ (Y)

6.10.1.6 Close the oxygen flow control valve.

(✔) 6.10.1.7 What is the minimum flow of oxygen? ___ ml (100-200) mL/min

(✔) 6.10.2 Nitrous Oxide Flowmeter Test

6.10.2.1 Set the oxygen flow to 4 L/min.

6.10.2.2 Connect the N_2O pipeline supply.

6.10.2.3 Is it possible to adjust the flow of nitrous oxide over the full range of the flowmeter? ___ (Y)

6.10.2.4 Is the correct flow control knob and label attached to the N_2O flow control valve? ___ (Y)

6.10.2.5 Close the oxygen and nitrous oxide flow control valves.

PMS PROCEDURE (continued)

(✔) 6.10.3 Air Flowmeter Test

6.10.3.1 Connect the Air pipeline supply and verify operation of the air flowmeter.

6.10.3.2 Close the air flow control valve and disconnect the Air pipeline supply.

6.10.3.3 Is the correct flow control knob and label attached to the air flow control valve? ___ (Y)

(✔) 6.10.4 Auxiliary Oxygen Flowmeter Test - If Applicable

6.10.4.1 Close the flowmeter flow control valve.

6.10.4.2 Connect a cm H_2O pressure manometer to the outlet.

6.10.4.3 Is there an increase in pressure? ___ (N)

6.10.4.4 Remove the gauge and test fixture.

6.10.4.5 Is it possible to adjust the flow over the full range of the flowmeter? ___ (Y)

6.10.4.6 Set the flow rate to 5 L/min.

6.10.4.7 Hold the sensor from a calibrated O_2Med at the flowmeter outlet.

6.10.4.8 After 90 seconds, what is the oxygen concentration? ___ % (97-100)

6.10.4.9 Remove the O_2Med sensor.

6.10.4.10 Close the flowmeter flow control valve.

6.11 Freshgas Leak Test

6.11.1 Turn the System Power switch to STANDBY.

6.11.2 Remove the 15 mm connector from the FRESHGAS OUTLET.

6.11.3 Is the common gas outlet assembly in good condition? ___ (Y)

6.11.4 Connect a digital pressure manometer and Fresh Gas Leak Test Device to the freshgas outlet.

6.11.5 Apply 50 cm H_2O of pressure to the system.

(✔) 6.11.6 After thirty (30) seconds, what is the pressure on the manometer? ___ (>40 cm H_2O)

6.11.7 Turn on the vaporizer to the first graduated marking.

6.11.8 Apply 50 cm H_2O of pressure to the system.

(✔) 6.11.9 After thirty (30) seconds, what is the pressure on the manometer? ___ (>40 cm H_2O)

6.11.10 Turn off the vaporizer.

6.11.11 Remove the test equipment from the Fresh Gas Outlet.

6.11.12 Turn the System Power switch to ON.

6.11.13 Open the O_2 flow control valve to 5 L/min., purge the system for 5 seconds, then close the O_2 flow control valve.

6.11.14 Turn the System Power switch to STANDBY.

6.11.15 Reconnect the 15 mm connector from the absorber system to the FRESHGAS OUTLET.

6.11.16 Is the FRESHGAS OUTLET label on the freshgas outlet? ___ (Y)

PMS PROCEDURE (continued)

6.12 Absorber System

(✔) 6.12.1 Absorber System Inspection

6.12.1.1 Remove the inspiratory and the expiratory valve domes.

6.12.1.2 Is there a broken or bent pin on the valve assembly?
Inspiratory ___ (N) Expiratory ___ (N)

6.12.1.3 Is there a broken pin on the valve domes?
Inspiratory ___ (N) Expiratory ___ (N)

6.12.1.4 Is the valve disc in good condition?
Inspiratory ___ (Y) Expiratory ___ (Y)

6.12.1.5 Are the valve dome washers in good condition? ___ (Y)

6.12.1.6 Reinstall the inspiratory and expiratory valve domes.

6.12.1.7 Remove the ultrasonic flow sensor connector hose.

6.12.1.8 Is the connector hose, connector, and O-ring in good condition? ___(Y)

6.12.1.9 Remove the ultrasonic flow sensor from the mounting bracket.

6.12.1.10 Remove the flow housing/transducer assembly from the electronics housing.

6.12.1.11 Remove both transducers from the flow housing; examine each O-ring and condition of all components, then reassemble.

6.12.1.12 Remove the inspiratory and expiratory valve assemblies.

6.12.1.13 Remove the PEEP valve.

6.12.1.14 Are all the washers in good condition? ___ (Y)

6.12.1.15 Reinstall the PEEP valve.

6.12.1.16 Reinstall the inspiratory and expiratory valves, and the connector hose between the expiratory valve and the ultrasonic flow sensor.

6.12.1.17 Is there a wing nut on each absorber rod?___ (Y)

6.12.1.18 Inspect the following: canisters and gaskets, dust cup and O-ring, condition of soda lime.

6.12.1.19 Is the canister and dust cup in good condition?___ (Y)

6.12.1.20 Is the cm H_2O gauge at zero (0)? ___ (Y)

6.12.1.21 Remove the O_2Med sensor plug from the inspiratory valve dome adapter and examine the two O-rings at the bottom of the plug.

6.12.1.22 Examine the two O-rings at the bottom of the sensor.

6.12.1.23 Reinstall the O_2Med sensor plug into the inspiratory valve dome adapter.

PMS PROCEDURE (continued)

6.12.2 Absorber System Leak Test

6.12.2.1 Turn the System Power switch to STANDBY.

6.12.2.2 Close all flow control valves.

6.12.2.3 Interconnect the inspiratory valve and the expiratory hose terminal on the ultrasonic flow sensor with a 12-inch hose.

6.12.2.4 Attach a test terminal with a cuff inflation bulb (P/N S01059) to the bag mount.

6.12.2.5 Set the Man/Auto selector valve to BAG.

6.12.2.6 Close the APL valve.

6.12.2.7 Apply 50 cm H_2O pressure to the absorber system.

(✔) 6.12.2.8 After 30 seconds, what is the pressure in the absorber system? ___ cm H_2O ($\geq$30)

6.12.3 APL Valve Test

6.12.3.1 Open the APL valve to its stop.

6.12.3.2 Turn the SYSTEM POWER switch to ON.

6.12.3.3 Set the oxygen flow to 8 L/min.

(✔) 6.12.3.4 What is the pressure on the absorber pressure gauge? ___ cm H_2O ($\leq$3)

6.12.3.5 Remove the test terminal from the bag mount.

6.12.3.6 Close the oxygen flow control valve.

6.12.4 Absorber Flow Direction and Leak Test

6.12.4.1 Expiration Valve Leak Test

6.12.4.1.1 Close the APL valve.

6.12.4.1.2 Connect a 22mm hose between the inspiration valve and the bag mount.

6.12.4.1.3 Connect a test terminal to the expiration valve.

6.12.4.1.4 Connect a Capnomed flowmeter to the test terminal.

6.12.4.1.5 Turn the System Power switch to ON, turn up the oxygen flow until the system pressurizes to 30 cmH_2O.

(✔) 6.12.4.1.6 Verify that the value indicated on the flowmeter is ≤60mL/min.

6.12.4.1.7 Remove all test equipment.

6.12.4.2 Inspiratory valve leak test

6.12.4.2.1 Connect a breathing pressure leak test device (P/N S010159) to the inspiratory valve.

6.12.4.2.2 Connect another test terminal to the bag connector.

6.12.4.2.3 Connect a Capnomed flowmeter to the test terminal on the bag mount.

6.12.4.2.4 Pressurize the system to 30 cmH_2O as indicated on the breathing pressure gauge.

(✔) 6.12.4.2.5 Verify that the flow meter indicates ≤60 mL/min.

6.12.4.2.6 Remove all test equipment.

6.12.4.2.7 Open the APL valve.

PMS PROCEDURE (continued)

6.12.4.3 Flow Direction Test

6.12.4.3.1 Attach a breathing circuit with a 3-liter bag at the Y-piece to the inspiration valve and the expiratory hose terminal on the ultrasonic slow sensor.

6.12.4.3.2 Attach a 3-liter bag to the bag mount.

6.12.4.3.3 Set the O_2 flow to 4 L/min.

6.12.4.3.4 Inflate the simulated lung by briefly using the O_2 Flush.

6.12.4.3.5 Partially close the APL valve.

6.12.4.3.6 Squeeze the breathing bag attached to the bag mount at a rate of approximately 10 BPM. Readjust the APL valve if required to properly ventilate the simulated lung.

(✔) 6.12.4.3.7 Observe the operation of each unidirectional valve disc at eye level and make sure the inspiratory valve disc raises only during the inspiration phase, and the expiratory valve raises only during the exhalation phase. Watch the valves until satisfied that both valves operate correctly, and move freely without sticking.

6.12.4.3.8 Open the APL valve.

(✔) 6.12.5 Absorber PEEP Valve

6.12.5.1 Connect a fresh gas leak test device (P/N 4113119) to the fresh gas outlet. Attach a test terminal (P/N 4104389) to the fresh gas leak test device. Remove the breathing bag from the patient Y-piece; attach test terminal to the Y.

6.12.5.2 Set the O_2 flow to 5 L/min.

6.12.5.3 Adjust the absorber PEEP valve clockwise to the maximum position.

6.12.5.4 What is the maximum PEEP? ___ cm H_2O ($\geq$15)

6.12.5.5 Does the PEEP valve adjust smoothly? ___ (Y)

6.12.5.6 Adjust the absorber PEEP valve counterclockwise to its minimum position.

6.12.5.7 Does the PEEP return to _3 cm H_2O? ___(Y)

6.12.5.8 Close the O_2 flow control valve.

6.12.5.9 Remove the adapter test hose.

(✔) 6.13 Calibration (O_2 Med Zero Cal, Baromed Zero Cal and Baromed Span)

6.13.1 To enter the Service screen, press the Oxygen High Limit key, the Volume High Limit key, and then the [▲] key.

6.13.2 Press the [▲] key and then select the SRVC Service Code. Enter your Technical Service Rep. I.D. number.

6.13.3 To bring up the Oxygen Monitor Service Screen, press the Mon Cal key.

6.13.4 Remove the oxygen sensor from the valve dome adapter.

6.13.5 Remove the oxygen sensor capsule from the oxygen sensor housing.

6.13.6 When the CURRENT CELL A and CURRENT CELL B readings have stabilized, press the ZERO key to store the values.

6.13.7 Put the oxygen sensor capsule into the oxygen sensor housing.

6.13.8 Press the PRESS MON key.

6.13.9 Disconnect the breathing pressure hose assembly from the interface panel.

6.13.10 Let the Current Pressure Value stabilize and press the ZERO key to store the value.

6.13.11 Connect a test fixture and digital pressure manometer to the breathing pressure interface panel.

6.13.12 Pressurize the circuit to 50 cm H_2O and allow the Current Value to stabilize.

6.13.13 Press the SPAN key to store the reading.

6.13.14 Release the pressure, disconnect the manometer and test fixture, and reconnect the breathing pressure hose assembly to the interface panel.

6.13.15 Press EXIT to return to the Main Service screen.

6.13.16 Press EXIT to return to normal operation.

PMS PROCEDURE (continued)

6.14 O_2Med (21% Calibration and Alarm Test)

6.14.1 Disconnect the oxygen sensor cable from the Oxygen Sensor interface.

6.14.2 The following message shall appear on the display: O2 SENS DISC.

6.14.3 Reconnect the O_2 Med sensor. CAL O2 SENSOR shall appear on the display.

6.14.4 Press the Cal key.

NOTE: Make sure that the sensor is exposed to only 21% O_2.

(✔) 6.14.5 After calibration is completed, what is the oxygen concentration? ___ % (21)

6.14.6 The warning INSP O2 LOW shall appear on the display and the warning heading shall be flashing. There shall be a continuous audible alarm.

6.14.7 What is the low oxygen alarm default? ___ % (30)

6.14.8 Select the OXYGEN LOW alarm limit. Does a box appear around the low alarm limit? ___ (Y)

6.14.9 Verify that the low alarm limit has a range from 18 to 99%.

6.14.10 Set the low limit to 18; the INSP O2 LOW message shall clear.

6.14.11 Select the OXYGEN HIGH alarm limit. Does a box appear around the high alarm limit? ___ (Y)

6.14.12 What is the high oxygen alarm default? ___ % (100)

6.14.13 Verify that the high alarm limit has a range from 100 to 19%.

6.14.13.1 Set the high alarm limit to 19.

6.14.14 The message INSP O2 HIGH shall appear as an Advisory.

6.14.15 Return the high alarm limit to 100.

6.14.16 The INSP O2 HIGH message shall disappear.

6.14.17 Place the oxygen sensor into the valve dome, set the oxygen flow to 5 L/min.,set the Man/Auto selector BAG, close the APL valve. Attach a 12-inch hose to the inspiratory valve and occlude the bag mount.

(✔) 6.14.18 After 3 minutes, what is the oxygen concentration? ___ % (97-100)

6.14.19 Close the oxygen flow control valve.

6.15 Baromed (Alarm Test)

6.15.1 Disconnect the breathing pressure hose assembly from the interface panel.

6.15.2 Connect a test pressure gauge and syringe to the breathing pressure interface panel.

6.15.3 Press the Breathing Pressure Threshold key. Does a box appear around the threshold alarm limit? ___ (Y)

6.15.4 What is the threshold alarm default? ___ cm H_2O (12)

6.15.5 Verify that the threshold alarm limit has a range from 5 to 30 cm H_2O.

6.15.6 Adjust the threshold to 10 cm H2O.

6.15.7 Press the Breathing Pressure High Limit key. Does a box appear around the high pressure alarm limit? ___ (Y)

6.15.8 What is the high alarm limit default? ___ cm H_2O (50)

6.15.9 Verify that the high alarm limit has a range from 30 to 120 cm H_2O.

6.15.10 Set the high alarm limit to 65 cm H_2O, and turn on the ventilator.

6.15.11 After the APNEA-PRESSURE alarm is displayed as a Warning, slowly increase the test pressure.

6.15.12 At what pressure does the APNEA-PRESSURE alarm deactivate? ___ cm H_2O (7-13)

6.15.13 Increase the pressure to 17 cm H_2O.

6.15.14 Bleed the pressure and start a stopwatch.

PMS PROCEDURE (continued)

NOTE: Apnea Pressure alarm times are valid only with ventilator ON.

(✔) 6.15.15 What is the time when APNEA-PRESSURE appears as a Caution?___ sec (13-17)

(✔) 6.15.16 What is the time when the APNEA-PRESSURE appears as a Warning? ___ sec (26-34)

6.15.17 Adjust the threshold to 18 cm H_2O.

6.15.18 Increase the pressure to 20 cm H_2O, maintain the pressure, and start a stopwatch.

(✔) 6.15.19 What is the time when CONTINUOUS PRES appears as a Warning? ___ sec (12-18)

(✔) 6.15.20 Decreasing the pressure slowly, what is the pressure at which the CONTINUOUS PRES alarm deactivates? ___ cm H_2O (15-21)

6.15.21 Slowly increase the pressure.

(✔) 6.15.22 At what pressure does the VENT PRESSURE HI alarm activate? ___ cm H_2O (62-68)

6.15.23 Bleed the pressure.

6.15.24 Slowly create a sub-atmospheric pressure.

(✔) 6.15.25 At what pressure does the SUB ATM PRESSURE alarm activate? ___ cm H_2O (-7 to -13)

6.15.26 Disconnect the test gauge and syringe; reconnect the breathing pressure hose assembly to the interface panel.

6.15.27 Does the SUB ATM PRESSURE alarm deactivate? ___(Y)

6.15.28 Press the Breathing Pressure Off key.

6.15.29 Verify that APNEA ALARM cannot be selected to OFF when the ventilator switch is ON.

6.16 Respiratory Volume

6.16.1 Press the Breathing Volume Low Limit key. Does a box appear around the minute volume alarm limit? ___ (Y)

6.16.2 What is the low minute volume alarm default? ___ (1.0)

6.16.3 Verify that the minute volume has a low alarm limit range from 0.5 to 10.0 by increments of 0.1.

6.16.4 Adjust the low minute volume alarm to 2.0 liters, and turn on the ventilator (with the breathing circuit open).

(✔) 6.16.5 What is the time when APNEA-VOLUME appears as a Caution? ___ sec (13-17)

(✔) 6.16.6 What is the time when APNEA-VOLUME appears as a Warning? ___ sec (26-34)

(✔) 6.16.7 After one (1) minute, does the MINUTE VOLUME LOW message appear as a Caution? ___ Y

6.16.8 Insert a test minute volumeter in between the absorber and the exhalation valve.

6.16.9 Attach a patient circuit with a 3-liter bag to the absorber system.

6.16.10 Place the Man/Auto selector in the AUTO position.

6.16.11 Adjust the FREQUENCY to 6 BPM.

6.16.12 Adjust the I:E RATIO to 1:2.

6.16.13 Adjust the flow to the maximum of the LOW zone.

6.16.14 Adjust the oxygen flow to 2 L/min.

6.16.15 Adjust the Tidal Volume to 200 ml.

6.16.16 After the first breath is detected, do the APNEA-VOLUME Warning message and the MINUTE VOLUME LO Caution message deactivate? ___ (Y)

PMS PROCEDURE (continued)

6.16.17 Adjust the low alarm limit above the indicated minute volume.

6.16.18 Does the MINUTE VOLUME LO message appear as a Caution? ___ (Y)

6.16.19 Adjust the low alarm limit below the indicated minute volume.

6.16.20 Does the MINUTE VOLUME LO Caution message deactivate? ___ (Y)

6.16.21 Increase the tidal volume to 1000 ml and the frequency to 10 BPM.

(✔) 6.16.22 Are the tidal volumes on the machine and on the volumeter within 20% of each other? ___ (Y)

(✔) 6.16.23 Are the minute volumes on the machine and on the test volumeter within 20% of each other? ___ (Y)

6.16.24 Create a reverse flow by removing the expiratory valve disc; reassemble the valve.

(✔) 6.16.25 Each time a reverse flow greater than 20 mL is detected, does the REVERSE FLOW message appear as an Advisory? ___ (Y)

6.16.26 Reinstall the expiratory valve disc and reassemble the expiratory valve.

6.16.27 Disconnect the sensor cord from the VOLUME SENSOR interface.

6.16.28 Do the VOL SENSOR DISC and VOL ALARMS OFF messages appear as Advisories? ___ (Y)

6.16.29 Connect the sensor cord to the Volume Sensor interface and verify that the alarms clear.

6.16.30 Turn off the ventilator.

6.16.31 Remove the test minute volumeter.

6.16.32 Press the Breathing Volume Off key to disable the volume alarms.

6.17 Ventilator Test

6.17.1 Set the Man/Auto selector to BAG.

6.17.2 Set the FREQUENCY to 10 BPM.

6.17.3 Set the I:E RATIO to 1:2.

6.17.4 Set the Tidal Volume to 1000 ml.

6.17.5 Attach a patient circuit to the absorber system.

6.17.6 Adjust the O_2 flow to 3 L/min.

6.17.7 Is the APNEA-P ALARM OFF message displayed in the Advisory column? (Y) (if no, enter the SET UP screen, select APNEA ALARM and select OFF).

6.17.8 Is the VOL-ALARMS OFF message displayed in the Advisory column? (Y) (if no, enter the SET UP screen, select VOLUME ALARMS and select OFF).

6.17.9 Set the Air/O_2 mode switch to O_2.

6.17.10 Turn the ventilator on.

6.17.11 Set the Man/Auto selector switch to AUTO.

6.17.12 Do the APNEA-P ALARM OFF and VOL-ALARMS OFF messages disappear from the Advisory column? (Y)

6.17.13 Adjust the INSPIRATORY FLOW to the maximum of the LOW zone.

6.17.14 Occlude the Y-piece with your thumb.

(✔) 6.17.15 What is the peak inspiratory pressure? ___ cm H_2O (>30 cm H_2O)

6.17.16 Attach a 3-liter bag to the Y-piece.

6.17.17 Using a stopwatch, time the inspiratory phase.

(✔) 6.17.18 What is the inspiratory time? ___ seconds (1.8 - 2.2)

6.17.19 Using a stopwatch, time the expiratory phase.

PMS PROCEDURE (continued)

(✔) 6.17.20 What is the expiratory time? ___ seconds (3.6 - 4.4)

6.17.21 Press and hold the EXTENDED RANGE switch and scroll the I:E ratio dial counter clockwise and verify the extended I:E ratio values increment (2:1, 3:1 and 4:1); return the I:E ratio to 2:1.

6.17.22 Using a stopwatch, time the inspiratory phase.

(✔) 6.17.23 What is the inspiratory time? ___ seconds (3.6 - 4.4)

6.17.24 Using a stopwatch, time the expiratory phase.

(✔) 6.17.25 What is the expiratory time? ___ seconds (1.8 - 2.2)

6.17.26 Adjust the FREQUENCY and I:E RATIO through the following settings and verify that the ventilator cycles properly:

FREQ.	I:E RATIO	FREQ.	I:E RATIO
11	1:1	66	1:3.5
22	1:1.5	77	1:4
33	1:2	88	1:4.5
44	1:2.5	99	1:4.5
55	1:3		

6.17.27 Connect the Air pipeline supply and set the Air/O_2 mode switch to Air. Does the ventilator continue to cycle properly? (Y)

6.18 Bellows Drive Gas Leak Test

6.18.1 Remove the ventilator hose from the VENTILATOR HOSE terminal.

6.18.2 Attach a test terminal to the bellows assembly ventilator hose terminal.

6.18.3 Connect a flowmeter test stand (P/N S000081) to the test terminal.

6.18.4 Set the FREQUENCY to 1 BPM.

6.18.5 Set the I:E RATIO to 1:1.

6.18.6 Set the INSPIRATORY FLOW to the maximum.

(✔) 6.18.7 What is the flow that is indicated during the inspiratory phase? ___ (<50 ml)

6.18.8 Remove the test terminal and flowmeter test stand. Reconnect the ventilator hose to the VENTILATOR HOSE terminal.

6.19 Bellows Test

6.19.1 Set the FREQUENCY to 10 BPM.

6.19.2 Set the I:E RATIO to 1:2.

6.19.3 Adjust the O_2 flow to 300 ml.

6.19.4 Adjust the INSPIRATORY FLOW to MED.

6.19.5 Adjust the Tidal Volume to 200 ml.

(✔) 6.19.6 What is the Tidal Volume on the test volumeter? ___ ml (125-250)

6.19.7 Adjust the Tidal Volume to 1000 ml.

(✔) 6.19.8 What is the Tidal Volume on the test volumeter? ___ ml (900-1100)

6.19.9 Adjust the INSPIRATORY FLOW to HIGH.

6.19.10 Adjust the O_2 flow to 5 L/min.

6.19.11 Adjust the Tidal Volume to maximum.

(✔) 6.19.12 What is the Tidal Volume on the test volumeter? ___ ml (_1400)

PMS PROCEDURE (continued)

6.20 Ventilator Relief Valve Test

6.20.1 Adjust the O_2 flow to 8 L/min.

6.20.2 Adjust the INSPIRATORY FLOW to MED.

6.20.3 Adjust the I:E RATIO to 1:3, and the FREQUENCY to 10.

6.20.4 Adjust the Tidal Volume to 1200 ml.

(✔) 6.20.5 What is the PEEP? ___ cm H_2O (≤3)

6.20.6 Adjust the O_2 flow to 500 ml.

(✔) 6.20.7 Does the ventilator deliver the full Tidal Volume during the inspiratory time? ___ (Y)

6.20.8 Does the bellows stop adjust smoothly? ___ (Y)

6.21 Inspiratory Pressure Limit Test

6.21.1 Set the Inspiratory Flow to the bottom of the low range.

6.21.2 Set the oxygen flow rate to 4 L/min.

6.21.3 Set the Pressure Limit Control to the MAX position.

6.21.4 Occlude the Y-piece with your thumb.

(✔) 6.21.5 Slowly increase the Inspiratory Flow setting until a peak pressure of 80 cm H_2O is achieved.

6.21.6 Set the Pressure Limit Control to 30.

(✔) 6.21.7 What is the peak pressure? ___ cm H_2O (27-33)

6.21.8 Set the pressure limit control to MIN.

(✔) 6.21.9 What is the peak pressure? ___ cm H_2O (9-15)

6.21.10 Remove your thumb from the Y-piece.

6.21.11 Set the Inspiratory Flow to the maximum of the LOW zone.

6.21.12 Close the oxygen flow control valve.

6.21.13 Turn the ventilator OFF.

NOTE: The inspiratory flow gauge will not return to the stop position when the ventilator is turned off.

(✔) **6.22 Audio Silence**

6.22.1 Turn the System Power switch to STANDBY; then turn it back to ON.

6.22.2 Verify the 120-sec. delay at power-up and allow a full countdown.

6.22.3 Press the Silence Alarms key (labeled with a crossed-out speaker).

6.22.4 Does the LED on the Silence Alarms key light?

PMS PROCEDURE (continued)

6.23 Oxygen Concentration Test

6.23.1 Oxygen + Nitrous Oxide Concentration Test

6.23.1.1 Turn the SYSTEM POWER switch to ON.

6.23.1.2 Connect the pipeline supplies

6.23.1.3 Open the APL valve.

6.23.1.4 Connect a 12-inch hose between the inspiratory valve and the expiratory valve.

6.23.1.5 Set the Man/Auto selector to BAG.

6.23.1.6 Occlude the bag mount.

6.23.1.7 Insert the sensor from a calibrated O_2Med into the valve dome adapter on the inspiratory valve.

6.23.1.8 Close all the flow control valves.

6.23.1.9 Depress the O_2 FLUSH button for 15 seconds.

6.23.1.10 Set the oxygen flow to 4 L/min.

6.23.1.11 Does the O_2Med read 97-100% within 3 minutes? ___ (Y)

6.23.1.12 Set the nitrous oxide flow to 2 L/min.

(✔) 6.23.1.13 What is the oxygen concentration after 3 minutes? ___ % (64-70)

6.23.1.14 Close the nitrous oxide flow control valve.

6.23.2 Oxygen + Air Concentration Test - If Applicable

6.23.2.1 Depress the O_2 FLUSH button for 15 seconds.

6.23.2.2 Does the O_2Med read 97-100% within 3 minutes? ___ (Y)

6.23.2.3 Set the air flow to 2 L/min.

(✔) 6.23.2.4 What is the oxygen concentration after 3 minutes? ___ % (71-77)

6.23.2.5 Close the air flow control valve.

6.24 Oxygen Ratio Control (ORC) Test

6.24.1 Remove the fresh gas hose from the fresh gas outlet.

6.24.2 Install fresh gas adapter assembly (P/N 4110425 into the fresh gas outlet.

6.24.3 Install the O_2 sensor housing into the fresh gas adapter assembly.

6.24.4 Connect the pipeline supplies.

6.24.5 Depress the O_2 FLUSH for 15 seconds.

6.24.6 Set the oxygen flow to 1000 ml.

6.24.7 Open the nitrous oxide flow control valve to the stop position.

(✔) 6.24.8 What is the oxygen concentration after 3 minutes? ___ % (22-28)

6.24.9 Adjust the oxygen flow to 1.5 L/min.

(✔) 6.24.10 What is the oxygen concentration after 3 minutes? ___ % (22-28)

6.24.11 Adjust the oxygen flow to 2 L/min.

(✔) 6.24.12 What is the oxygen concentration after 3 minutes? ___ % (22-28)

6.24.13 Adjust the oxygen flow to 4 L/min.

(✔) 6.24.14 What is the oxygen concentration after 3 minutes? ___ % (22-28)

6.24.15 Reduce the O_2 flow to 500 mL/min. Verify that the N_2O flow is greater than or equal to 600 mL/min.

6.24.16 Slowly close the oxygen flow control valve.

(✔) 6.24.17 What is the flow of O_2 when the nitrous oxide reaches its threshold level? ___ (250-400 mL/min.)

6.24.18 What is the flow of nitrous oxide? ___ mL/min. (0)

6.24.19 What is the oxygen concentration with the O_2 flow control valve closed? ___% (22-28)

6.24.20 Close the nitrous oxide flow control valve.

PMS PROCEDURE (continued)

6.25 Oxygen Flush and 100% O_2 Final Test

6.25.1 Disconnect the N_2O and Air pipeline supplies.

6.25.2 Turn the SYSTEM POWER switch to ON.

6.25.3 Set the oxygen flow rate to 5 L/min.

6.25.4 Fully open the nitrous oxide and air flow control valves.

6.25.5 After the nitrous oxide and air flows stop, close their flow control valves.

6.25.6 Close the oxygen flow control valve.

6.25.7 Turn the SYSTEM POWER switch to STANDBY.

6.25.8 Press and release the O_2 FLUSH button.

6.25.9 Does the flow of oxygen stop immediately? __ (Y)

6.25.10 Remove the exhalation valve from the absorber. Attach test minute volumeter (P/N 2212300) to the exhalation valve. Connect volume test device (P/N S010158) from the fresh gas outlet to the exhalation valve hose terminal.

6.25.11 Press and hold the O_2 FLUSH button for 15 seconds; multiply the volumeter reading by 4.

(✔) 6.25.12 What is the oxygen flush flow rate? ___ L/min. (45-65)

6.25.13 Remove the test minute volumeter and test fixture, and reconnect the fresh gas hose. Reconnect the exhalation valve.

6.25.14 Turn the SYSTEM POWER switch to ON.

6.25.15 Insert the sensor from a calibrated O_2Med into the inspiratory valve dome.

6.25.16 Press the O_2 FLUSH button.

(✔) 6.25.17 What is the O_2 concentration after 3 minutes? ___ % O_2 (97-100)

6.25.18 Remove the O_2Med sensor and install the plug.

6.25.19 Close the oxygen cylinder valve.

6.25.20 Bleed the oxygen circuit by pressing the O_2 FLUSH button.

(✔) 6.26 Scavenger, Passive Mode

6.26.1 Remove all scavenger hoses one at a time, and drain all accumulated moisture. Inspect all scavenger hoses for deterioration and replace any worn hoses.

6.26.2 Ensure that the suction needle valve (not used in passive mode) is closed.

6.26.3 Positive Pressure Test:

6.26.3.1 Connect a 19 mm scavenger hose between APL valve and the scavenger port. Connect another 19 mm scavenger hose between the ventilator relief valve and the second port on the scavenger.

6.26.3.2 Connect a short 22 mm breathing hose from the inspiratory valve to the expiratory valve on the absorber.

6.26.3.3 Set the Man/Auto valve to the AUTO position.

6.26.3.4 Turn the PEEP valve control knob fully counter-clockwise.

6.26.3.5 Set the oxygen flow to 8 L/min. and occlude the 19 mm scavenger terminal labeled EXHAUST.

6.26.3.6 After the ventilator bellows inflates, the flow of oxygen will exit the system through the positive pressure safety relief valve. At this point, the absorber system breathing pressure gauge shall indicate a pressure of 10 cm H_2O or less.

PMS PROCEDURE (continued)

(✔) 6.27 Scavenger, Suction Mode

6.27.1 Check all scavenger hoses and reservoir bag for deterioration. Replace all worn components.

6.27.2 Remove the filter from the vacuum relief valve; clean and reinstall the filter.

6.27.3 Negative Pressure Test:

6.27.3.1 Connect a 22mm breathing hose between the absorber's inspiratory and expiratory valves. Set the Man/Auto valve to the BAG position. Turn the APL valve fully counter-clockwise. Occlude the bag mount connector.

6.27.3.2 Verify that the suction waste gas disposal system is active.

6.27.3.3 Close all flow control valves on the machine. Adjust the scavenger needle valve to allow typical suction through the scavenger.

6.27.3.4 Install a scavenger adapter (P/N 4108114) with a hose barb between the 19mm hose terminal of the scavenger and the scavenger hose. Connect a test monitor to the hose barb adapter and observe the pressure reading on the test gauge. The gauge shall indicate a pressure no lower than -0.5 cmH_2O.

6.27.4 Positive Pressure Test:

6.27.4.1 Close the scavenger needle valve by turning it fully clockwise.

6.27.4.2 Push the O_2 Flush button to inflate the scavenger reservoir bag. Open the oxygen flow control valve to 8 L/min.

6.27.4.3 Observe the pressure reading on the test gauge. The gauge shall indicate a pressure of 10 cm H_2O or less.

6.27.4.4 Remove the test equipment. Readjust the scavenger needle valve to allow typical suction through the scavenger.

(✔) 6.28 Reset Date and PMS Criteria

6.28.1 Reset Date

6.28.1.1 Power the machine up.

6.28.1.2 Access the Main Service screen.

6.28.1.3 Select the SRVC Service Code.

6.28.1.4 Select and enter your Technical Service Rep. I.D. number.

6.28.1.5 Press the RESET key. This resets the last service date to the current date and resets the hours run since last service to zero.

6.28.2 Set PMS Criteria

6.28.2.1 Press the PMS Criteria key.

6.28.2.2 Select and enter the month of the next service due date. The internal clock of the machine limits the amount of date advance to a maximum of six months from the current service date.

(✔) 6.29 Final Check

6.29.1 Verify that the pipeline hoses are connected to the hospital pipeline.

6.29.2 Verify that the APL valve knob is turned completely counterclockwise, fully open.

6.29.3 Place the Auto/Man selector in the BAG position.

6.29.4 Verify that the O_2Med sensor is removed from the valve dome adapter.

6.29.5 Verify that the valve dome is plugged.

6.29.6 Verify that the machine is plugged into a live outlet.

6.29.7 Return all machine controls and settings to their original state.

RETURN TO THIS MANUAL'S TABLE OF CONTENTS
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7.0 Software Update Procedure

This section outlines the software installation procedure, including the equipment needed and its connections.

Software updates to the Narkomed Mobile anesthesia system are done through a serial port connection to an external PC using the batch file LOADM.BAT.

7.1 Software Transfer to PC Via Modem

Equipment required:

- Interface Cable, NAD Part No.4109882 P (9-pin to 25-pin)
  or 4110328 A (9-pin to 9-pin)
- IBM® PC or IBM PC Compatible configured with:
  - PC-DOS or MS-DOS V3.3 or higher
  - RS-232C Serial Port connected to COM 1
  - Hard Drive or Floppy Drive
  - Modem (or external modem)

7.1.1 Download the software to the hard disk or use Drive A (floppy drive) on the PC.

7.2 Installing Narkomed Mobile Software from a PC

7.2.1 Set the System Power switch on the Narkomed Mobile to STANDBY, and the power switch on the PC to OFF.

7.2.2 Connect the appropriate interface cable (9-pin or 25-pin) to COM 1 on the PC, and connect the other end of the cable to the Narkomed Mobile serial interface port as shown in Figure 7-1.

7.2.3 Power up the PC and wait for the DOS prompt to appear on the screen.

7.2.4 Set the PC to read the drive holding the software. For example: if the software was downloaded to drive A, type A: and press ENTER.

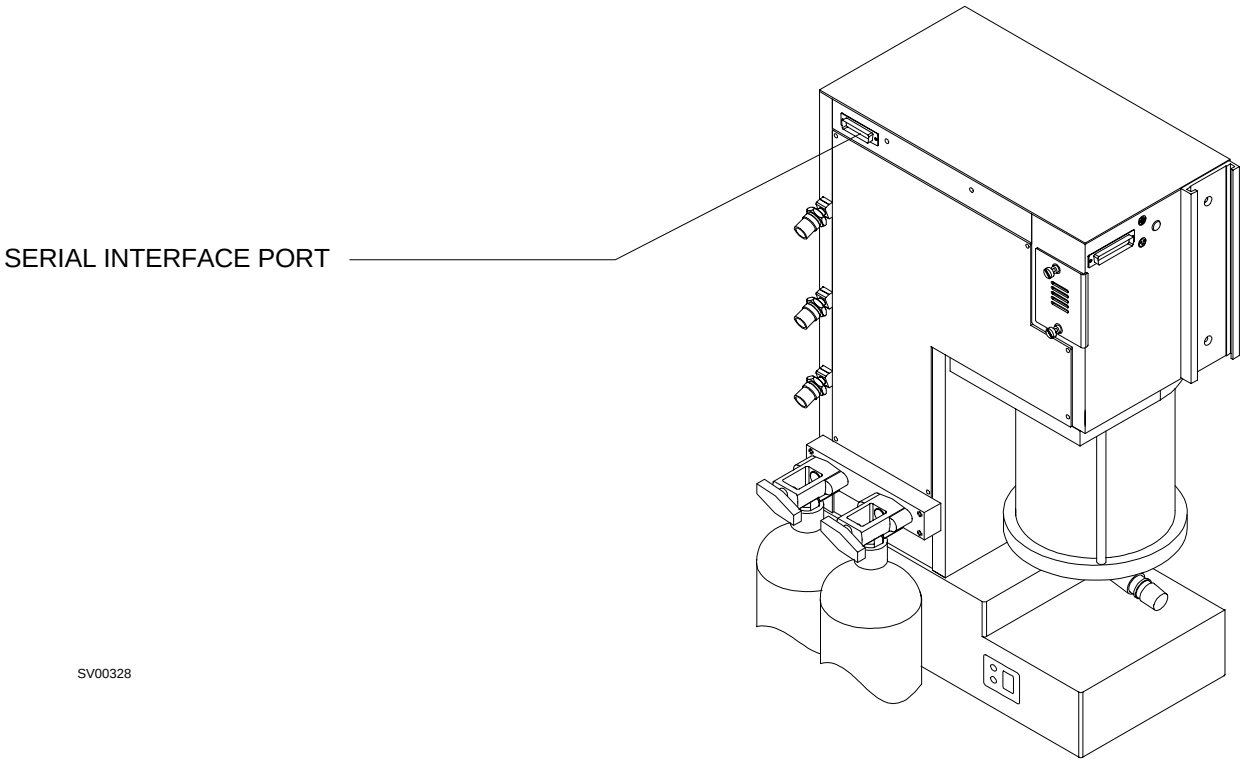


Figure 7-1. Narkomed Mobile Serial Port Location

7.2.5 Type LOADNMM and press ENTER.

7.2.6 Turn the System Power switch to ON.

7.2.7 As the software is downloading, the Narkomed Mobile screen will be blank for approximately 5 to 7 minutes, and the incremental number of bytes sent will be displayed on the PC screen. When the download is complete, the PC screen will display

```
\       Bytes sent:    0    Images sent:    1
```

Software installation is complete when the machine resets.

7.2.8 Set the System Power switch on the machine to STANDBY, and the power switch on the PC to OFF. Disconnect the interface cable.

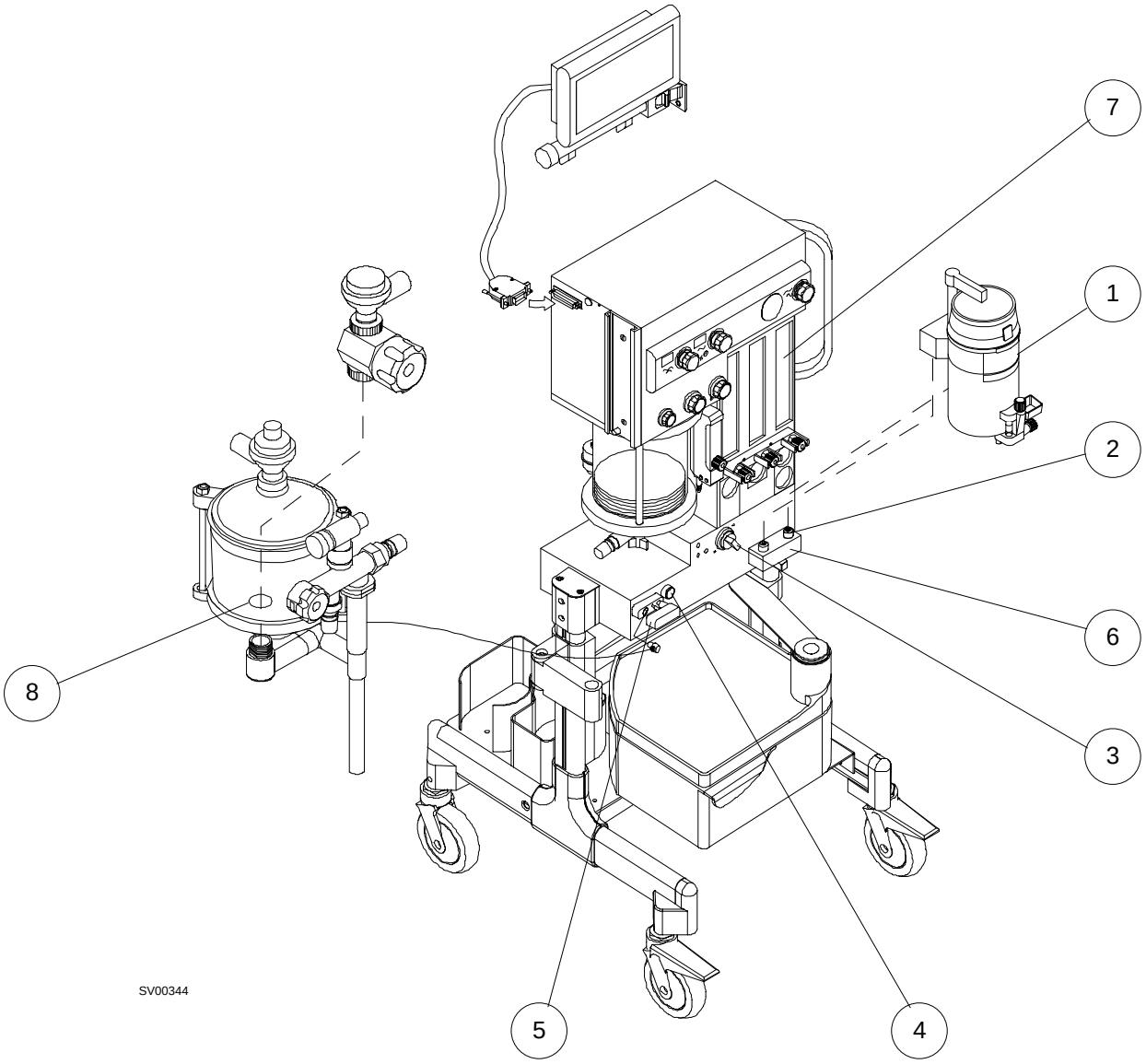
8.0 Spare and Replacement Parts

Part numbers for field-replaceable items on the Narkomed Mobile anesthesia system are listed on the following pages, along with part numbers for related hardware and cables.

The item numbers are keyed to the accompanying illustrations to aid in identifying the item and its location.

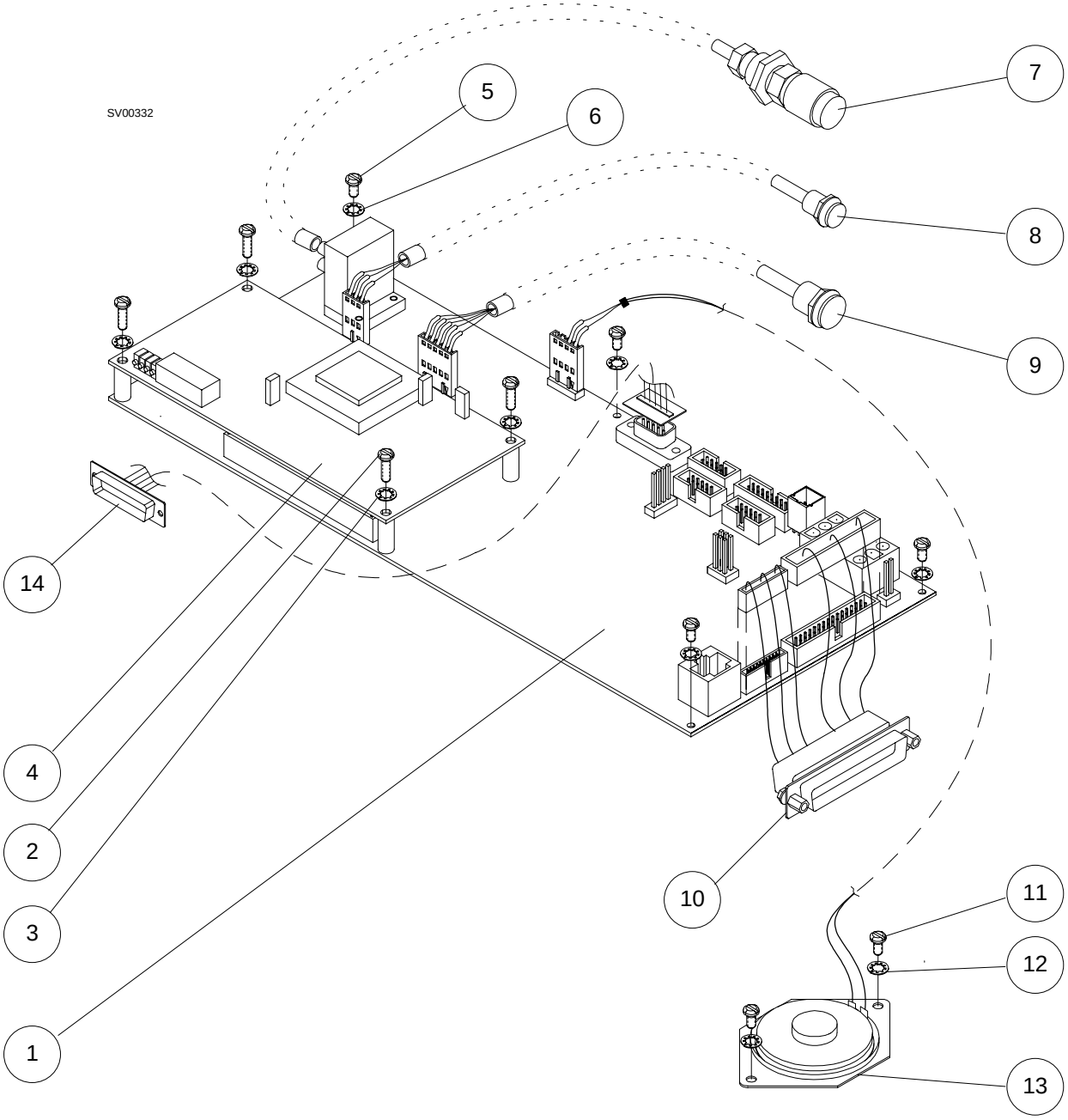
ASSEMBLY/PART **PAGE**

SPARE AND REPLACEMENT PARTS (continued)



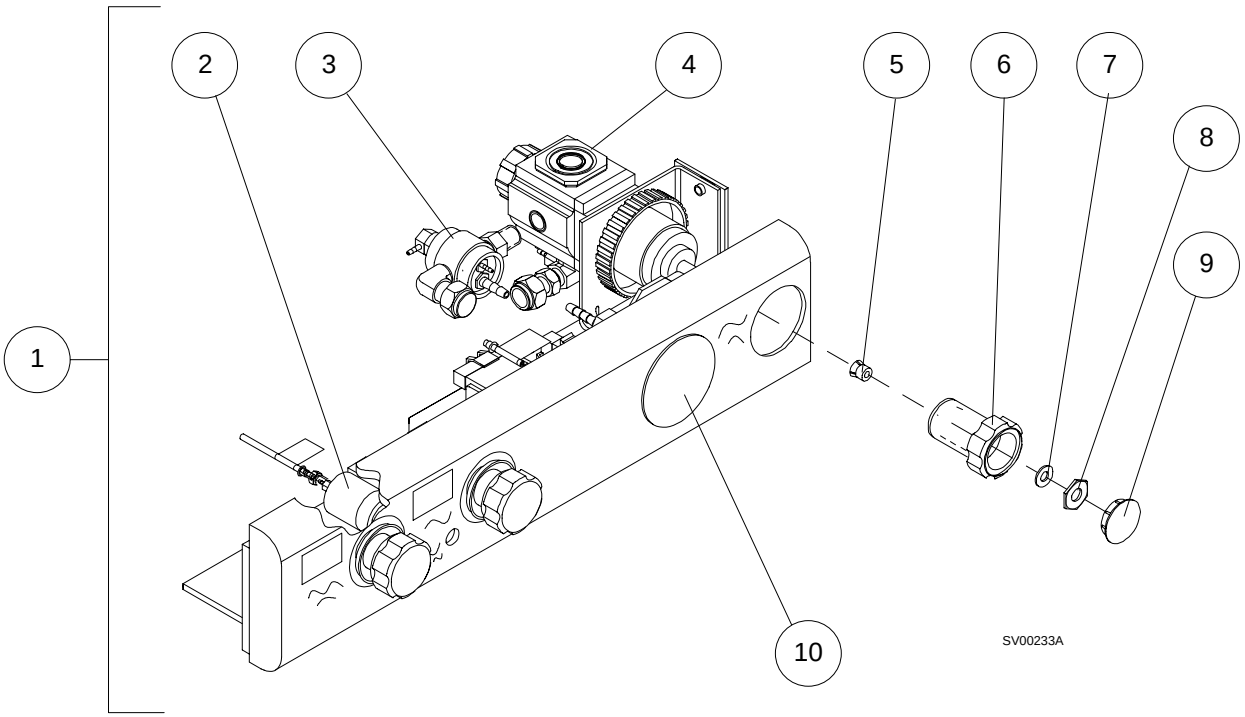
ITEM	DESCRIPTION	PART NUMBER
1	Vaporizer	Dräger 19.3
2	O-ring, vaporizer post (2x)	S4114346
3	Mainswitch Assembly	4114278
4	O_2 Flush valve	4103340
5	Fresh Gas outlet assembly	4108673
6	Vapor block assembly	4115019-004
7	Flowmeter sub-assembly	4114276-001
8	Gasket	1101690-001

SPARE AND REPLACEMENT PARTS (continued)



ITEM	DESCRIPTION	PART NUMBER
1	PCB Asm, Personality	4113549
2	Screw, 4-40 x 1.62 in. cap skt hd (4x)	HW01102
3	Lock Washer, #4 int-t (4x)	HW67001
4	PCB Asm, Common Processor	4113595
5	Screw, 8-32 x ⅜ in. btn hd skt (4x)	HW09018
6	Lock Washer, #8 int-t (4x)	HW67011
7	Hose, 0.13 ID, 8 in.	ML08007
	Fitting, 0.13 hose x ⅛ MPT	4102963
	Nut, Panel 9/16 - 18	4108156
	Quick-disconnect Fitting	4108155
8	O_2 Interface Cable Assembly	4113909-001
9	Volume Interface Cable Assembly	4113910-001
10	Cable Assembly, Display Interface	4114288
11	Screw, 6-32 x ¼ in. btn hd skt (2x)	HW09076
12	Lock Washer, #6 split (2x)	HW65001
13	Speaker Mounting Bracket	4113285
	Speaker Assembly (includes wire harness and connector)	4114366
14	Cable Assembly, Serial Port	4113760-001

SPARE AND REPLACEMENT PARTS (continued)



ITEM	DESCRIPTION	PART NUMBER
1	Ventilator Controller Assembly (Bezel Assembly)	4114283
2	Solenoid	4110906
3	Valve, air piloted	4114047
4	Regulator	4114252
5	Collet (3x)	4112167
6	Knob (3x)	4113281
7	Washer, #10 flat (3x)	HW66003
8	Nut, hex M5 x 0.5 (3x)	4112066
9	Cover (3x)	4113278-002
10	Gauge	4112251-001
	Lens	4112213

Mounting hardware for controller assembly:

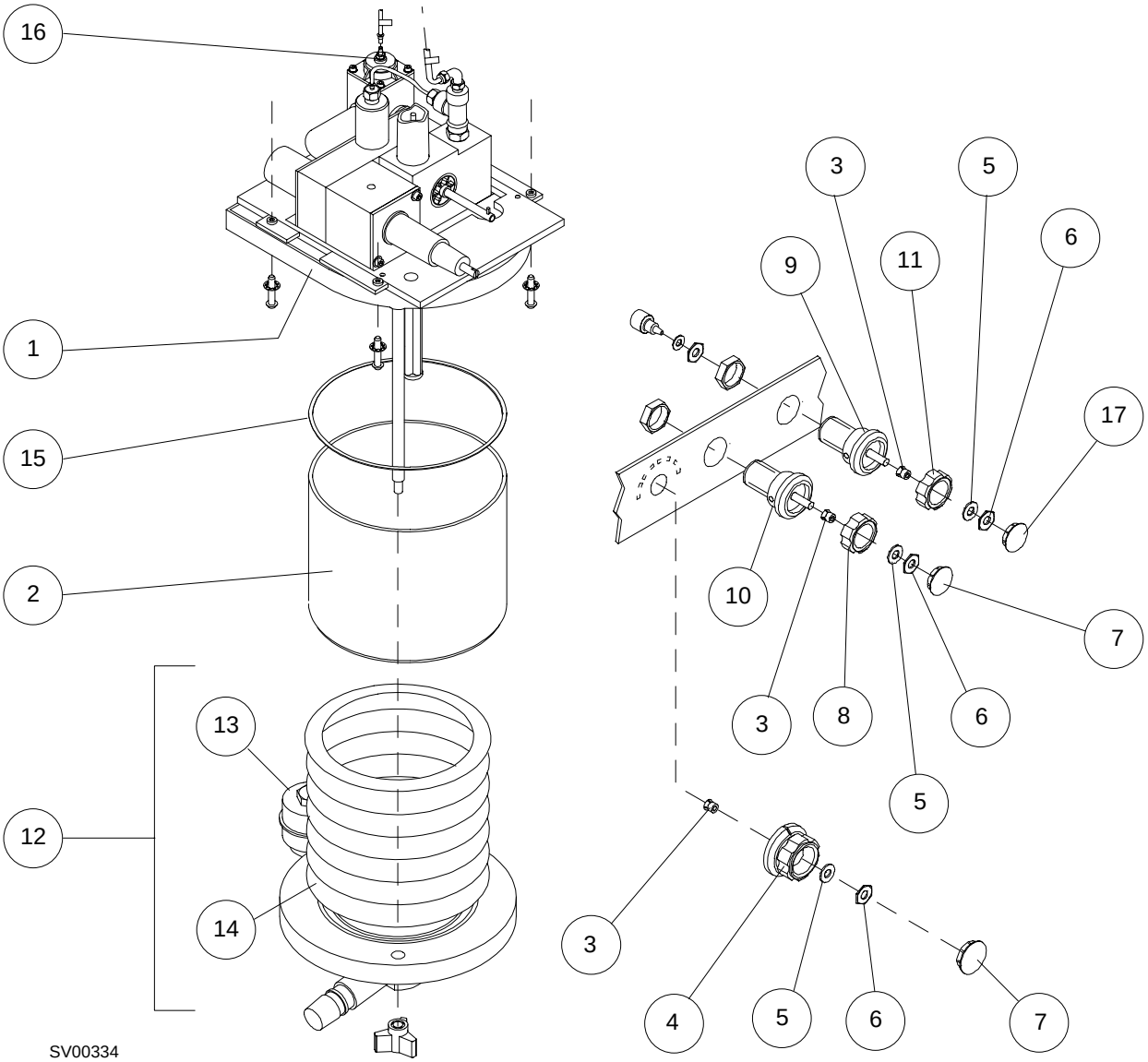
Base plate mounting:

Screw, 8-32 x ⅜ in. cap skt hd (2x)	HW01012
Lock Washer, #8 split (2x)	HW65011
Flat Washer, #8 (2x)	HW66002

Rear of hex standoffs:

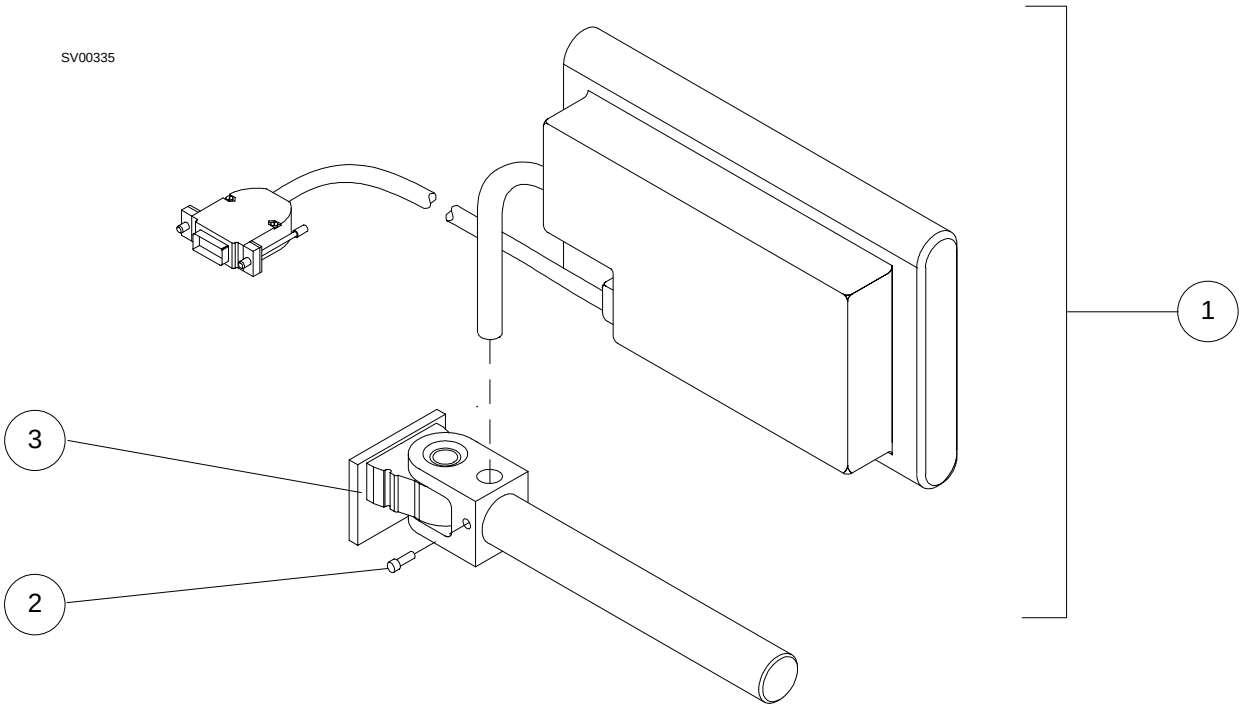
Screw, 6-32 x ½ cap skt hd (2x)	HW01010
Lock washer, #6 int-t (2x)	HW67007
Flat Washer, #6 (2x)	HW66006

SPARE AND REPLACEMENT PARTS (continued)



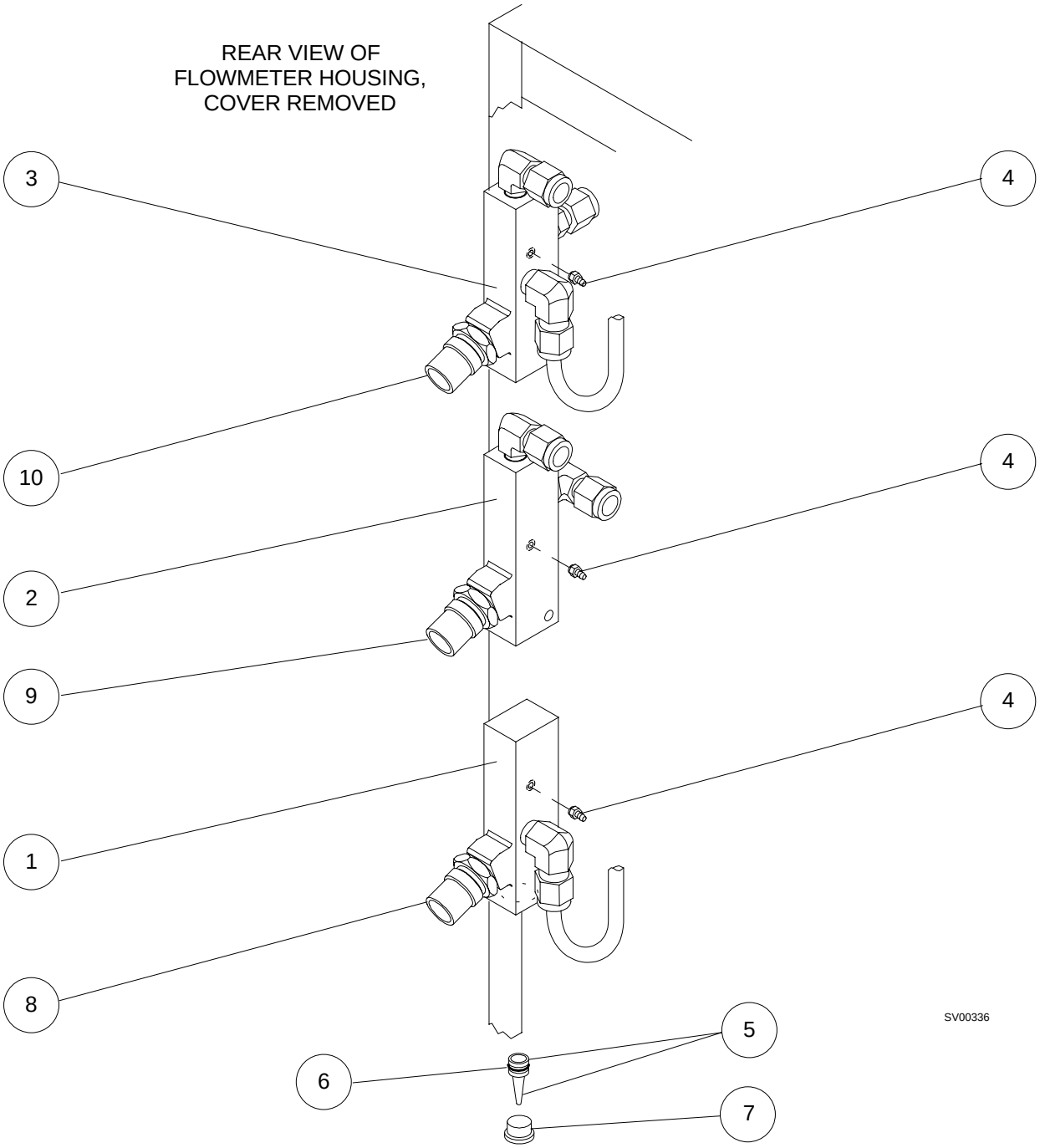
ITEM	DESCRIPTION	PART NUMBER
1	Bellows Valve Assembly	4112272-001
2	Canister	4106948
3	Collet (3x)	4112167
4	Knob, PLC Adj	4113279
5	Flat Washer, #10 (3x)	HW66003
6	Hex Nut, M5 x 0.5 (3x)	4112066
7	Knob Cover (2x)	4113278-002
8	Knob, Tidal Vol Adj	4113280
9	Housing	4114011
10	Housing w/push to turn asm	
11	Knob, Off-On Switch	4113281
12	Bellows Assembly	4114102
13	Relief Valve Assembly	4108050
	Diaphragm Assembly	4110960
14	Urethane (Non-Latex) Bellows Sub-assembly, Adult	4106930-001
	O-ring #217 (neoprene)	4101817
15	O-ring #256, canister gasket	4107018
16	Hose barb fitting, 1/16 ID x 10-32 w/seal	4112707-001
17	Knob Cover	4113278-001

SPARE AND REPLACEMENT PARTS (continued)



ITEM	DESCRIPTION	PART NUMBER
1	Display Assembly (includes mounting rod)	4114249
2	Screw, 6-32 x ⅝ in., skt hd	HW01067
3	Joint Assembly and Monitor Support Arm	4114286

SPARE AND REPLACEMENT PARTS (continued)

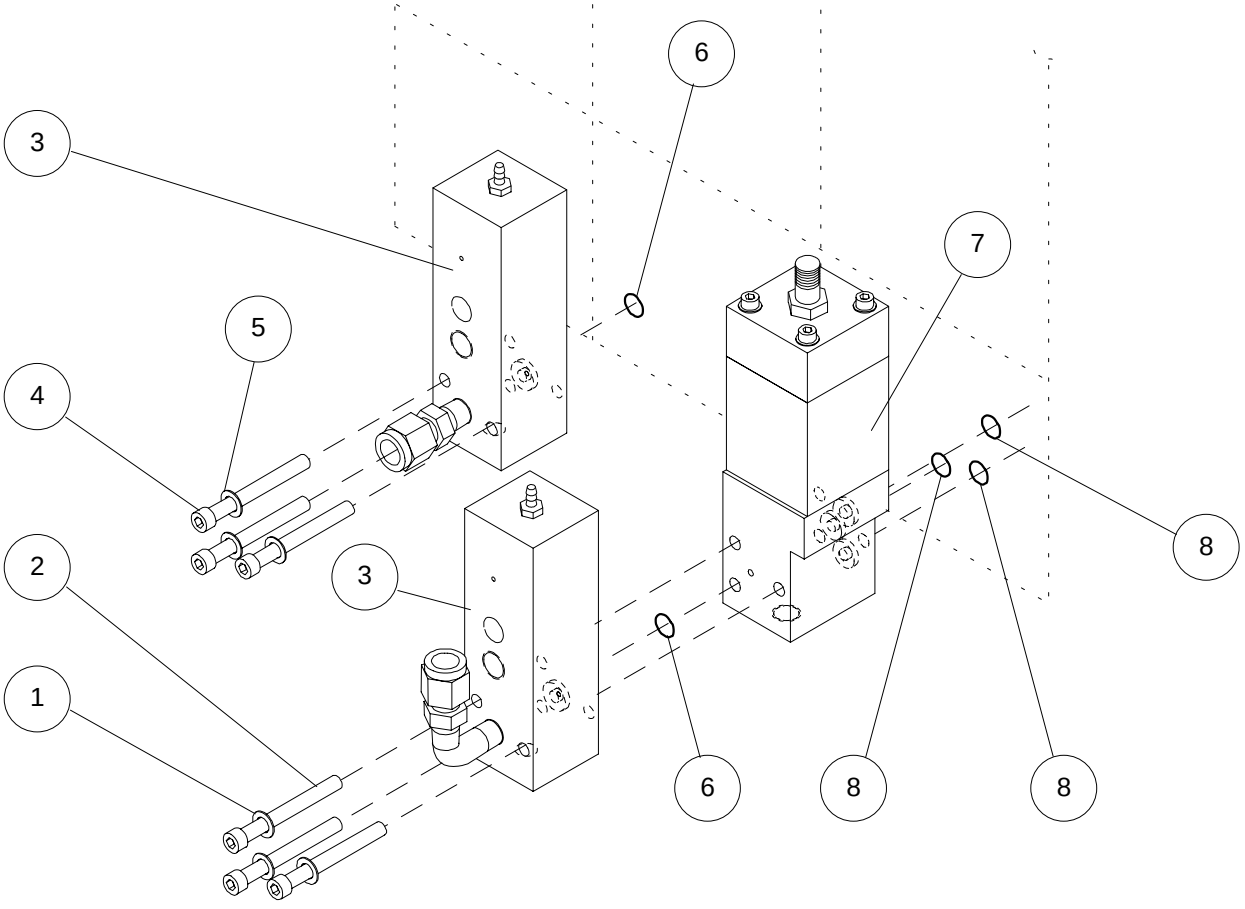


ITEM	DESCRIPTION	PART NUMBER
	Pipeline Inlet Assemblies:	
1	N_2O Inlet Manifold (incl. fittings and filter)	4115047
2	Air Inlet Manifold (incl. fittings and filter)	4115045
3	O_2 Inlet Manifold (incl. fittings and filter)	4115046
4	Hose Barb Fitting, 1/16 ID x 10-32 w/ seal	4112707-001
	Typ., all inlet assemblies:	
5	Filter and Connector (assembled, incl. O-ring)	4114345
6	O-ring (neoprene)	4112619-009
7	Plug	4114328
	O-ring for N_2O DISS Nipple	4113494
8	Body, DISS N2O x ⅛ MPT	4111384
9	Body, DISS Air x ⅛ MPT	4102886
10	Body, DISS O2 x ⅛ MPT	4102563

SPARE AND REPLACEMENT PARTS (continued)

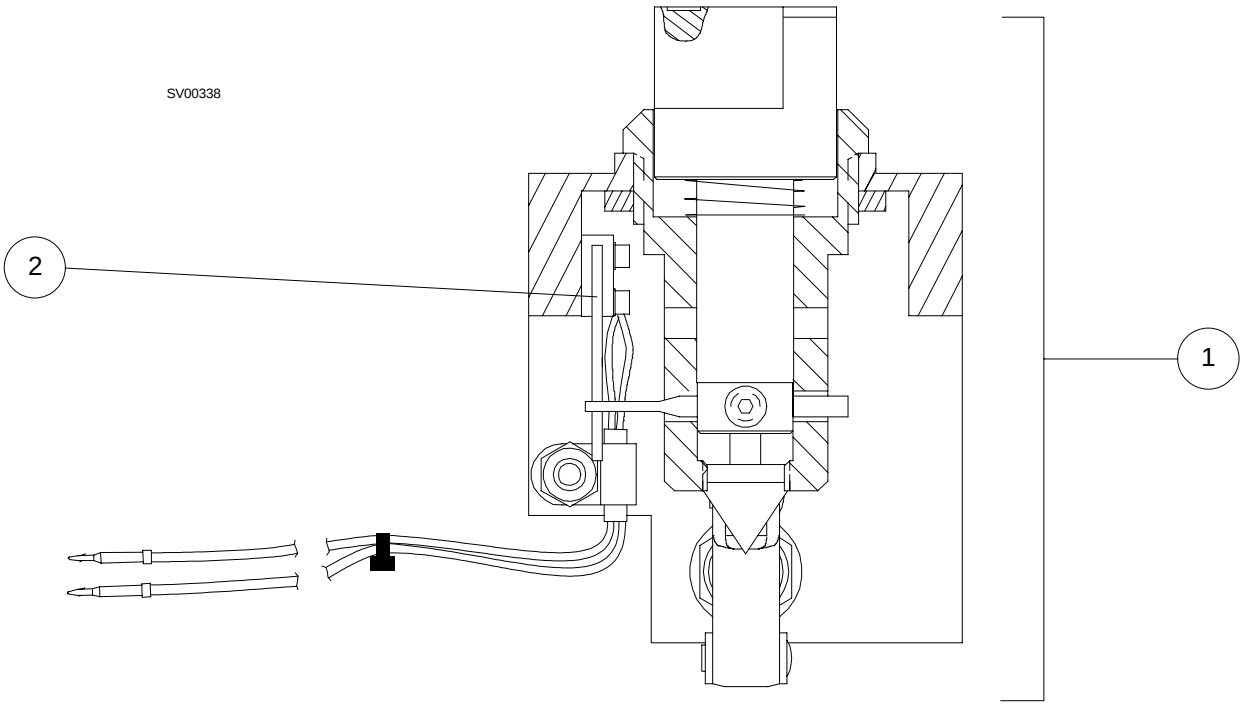
SV00337

REAR VIEW OF
FLOWMETER SUB-ASSEMBLY
(PARTIAL)



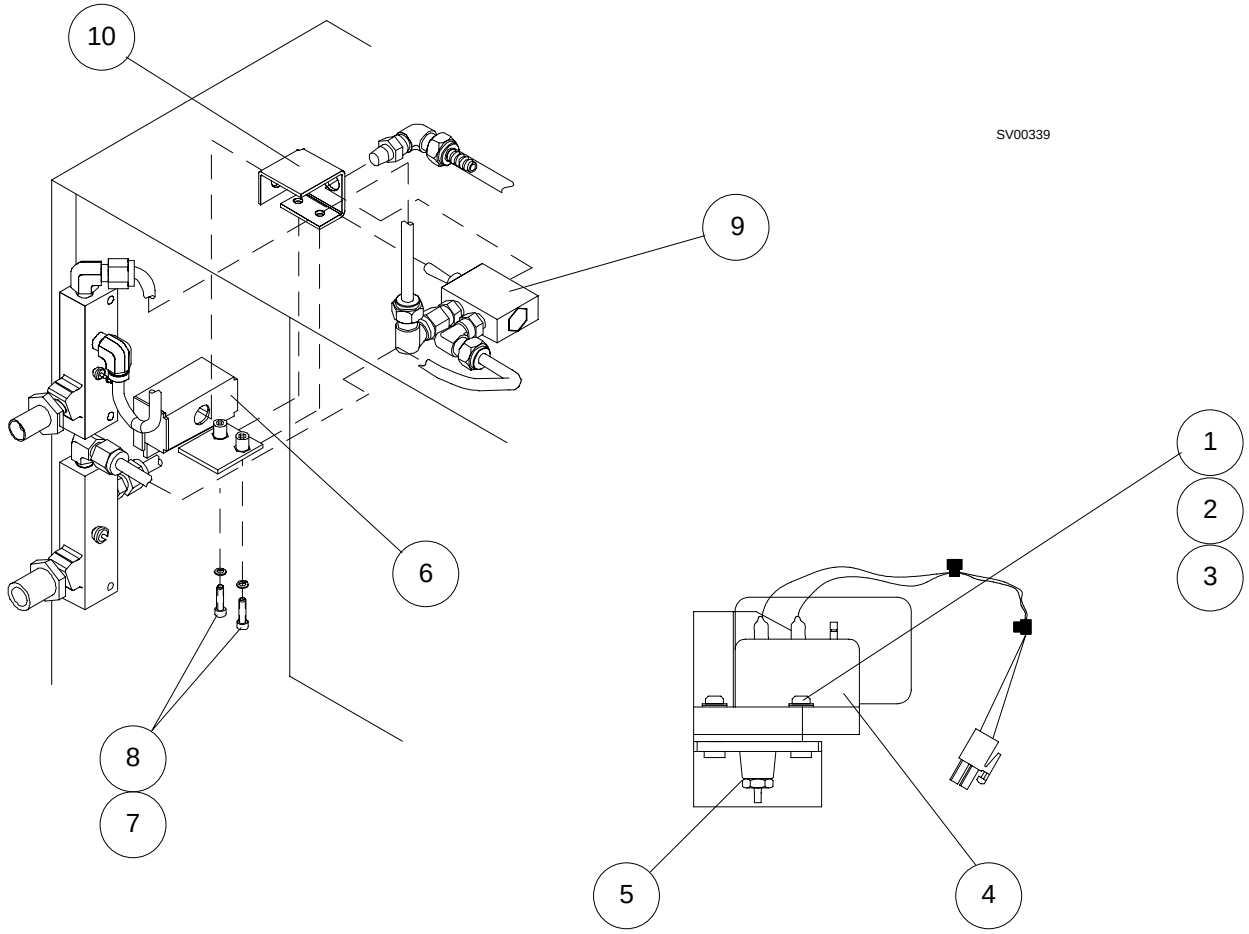
ITEM	DESCRIPTION	PART NUMBER
1	Lock Washer, #8 split (3x)	HW65011
2	Screw, 8-32 x 1⅜ in. cap skt hd (3x)	HW01110
3	OFPD (Failsafe Assembly) (2x)	4114031
4	Screw, 8-32 x 3 in. cap skt hd (3x)	HW01090
5	Lock Washer, #8 split (3x)	HW65011
6	O-ring, #105 (neoprene)	4111893
7	ORC Assembly	4114277-001
8	O-ring, #105 (neoprene)	4111893
	Not shown:	
	Filter	4111805
	O-ring, 0.166 x 0.042 (Buna-N)	4111894

SPARE AND REPLACEMENT PARTS (continued)



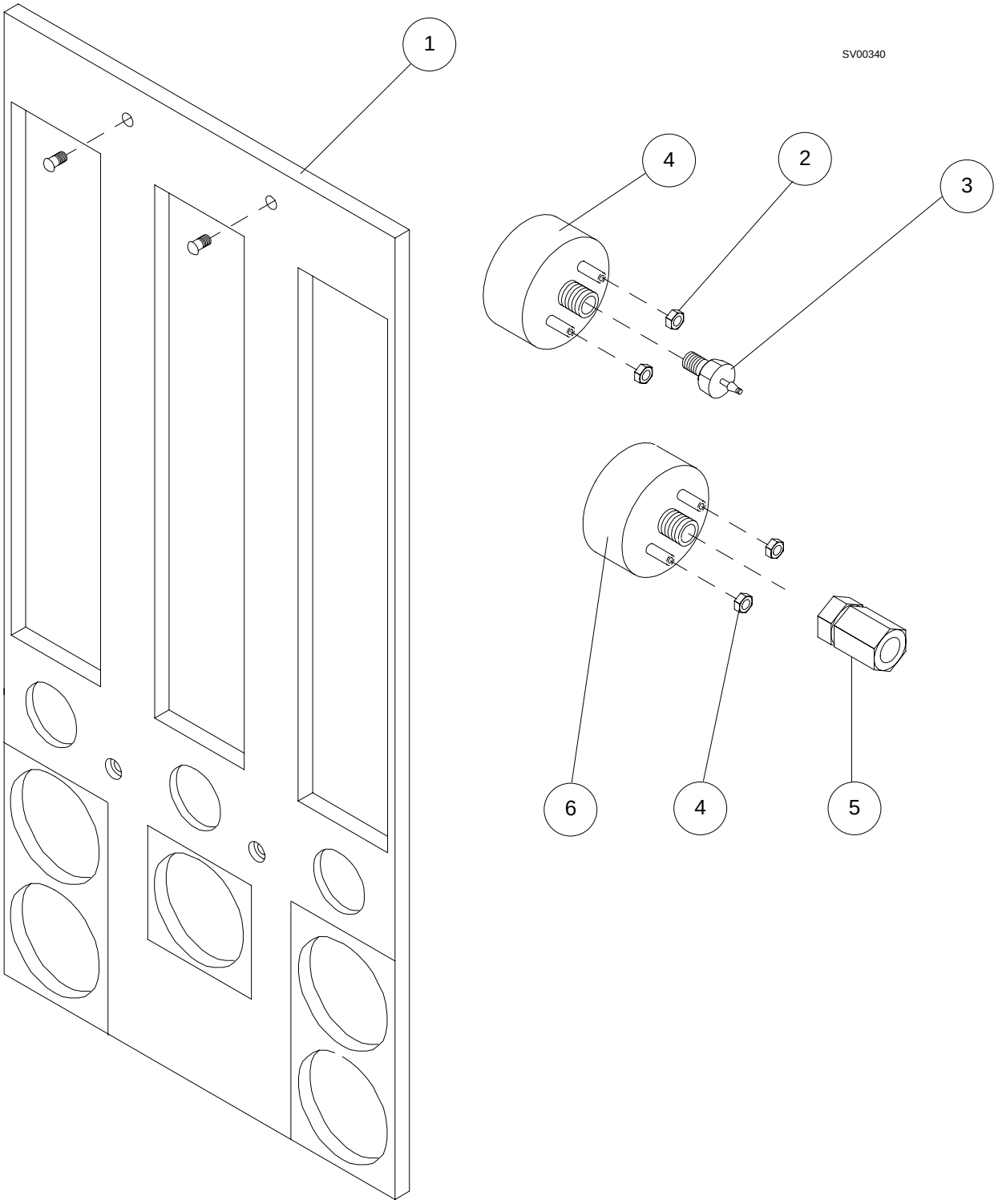
ITEM	DESCRIPTION	PART NUMBER
1	Main Switch Assembly	4114278
2	Switch Assembly (incl. leaf switch, wire harness & connector)	4114318

SPARE AND REPLACEMENT PARTS (continued)



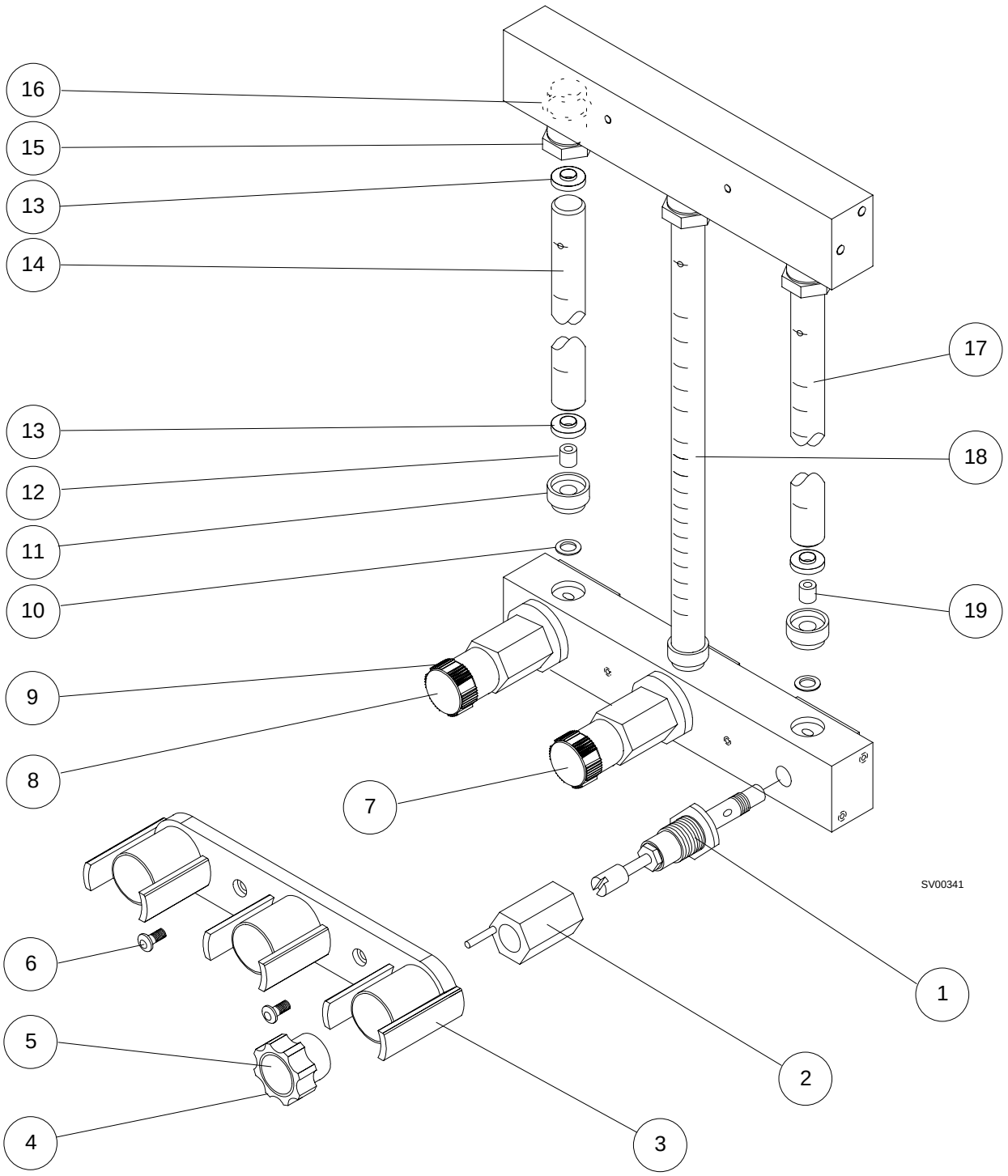
ITEM	DESCRIPTION	PART NUMBER
	O_2 Supply Pressure Switch:	
1	Screw, 2-56 x 5/8 in. btn hd skt (4x)	HW09085
2	Lock Washer, #2 int-t (4x)	HW67012
3	Flat Washer, #2 (4x)	HW66009
4	Switch assembly (incl. wire harness)	4114331
5	Fitting, straight 1/16 ID x 10-32m w/seal	4112707-001
	O_2 - Air Switch:	
6	Housing	4114310
7	Screw, 8-32 x 7/16 in. cap skt hd (2x)	HW01013
8	Lock Washer, #8 split (2x)	HW65011
9	Switch (Valve, 3-way)	4115136
10	Bracket	4115137

SPARE AND REPLACEMENT PARTS (continued)



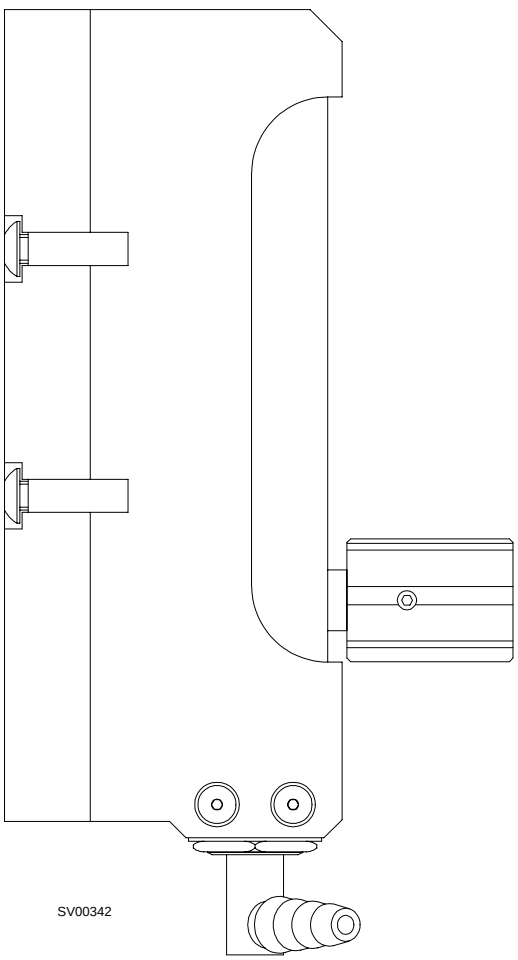
ITEM	DESCRIPTION	PART NUMBER
1	Shield, Flowmeter, 3-Gas (Air) NMM	4115124
2	Gauge, 100 psi NMM (3x)	4114247-001
3	Hose barb ftg, 1/16 ID x 10-32 w/seal (3x) (pipeline gauges)	4112707-001
4	Kep Nut, (2x per gauge)	HW55003
5	Straight Fitting (cylinder gauges)	4109402
6	Gauge, 3000 psi NMM (2x)	4114247-002

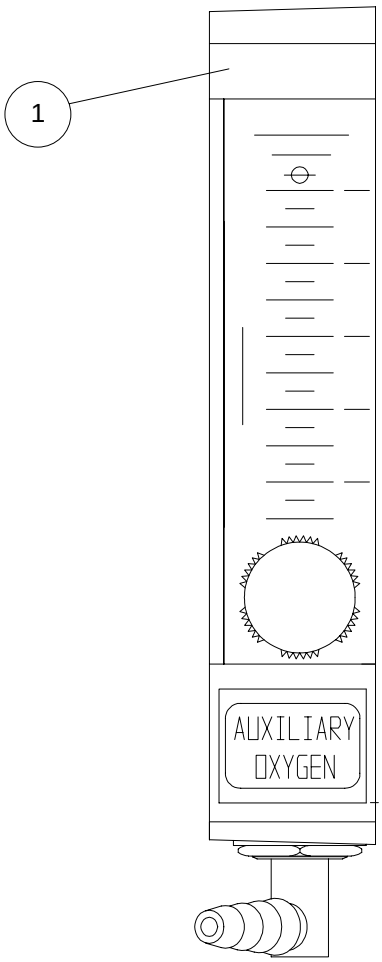
SPARE AND REPLACEMENT PARTS (continued)



ITEM	DESCRIPTION	PART NUMBER
1	Flow Control Valve (3x)	4114036
2	Stop Pin Nut (3x)	4111892
3	Knob Guard, 3 Gas	4110574
4	Knob, O_2	4103156
5	Label, O_2 Flow Control Knob, Green (USA)	4103178
6	Screw, 6-32 x 7/16 btn hd (2x)	HW09017
7	Label, Air Flow Control Knob, Yellow (USA, Germany)	4103905
8	Label, N_2O Flow Control Knob, Blue (USA, UK, Canada)	4103904
9	Knob, Flow (2x)	4103736
10	O-ring, #010 (neoprene) (2x)	4101872
11	Restrictor Housing (2x)	4103440
12	Restrictor, N_2O, black	4110738-005
13	Gasket and Guide Ring (2x each flow tube)	4102724
14	Flow Tube, N_2O, 0.1 - 8L	4114263
15	Connector (Flow tube retainer) (3x)	4114017
16	O-ring, #109 (EPDM) (3x)	4112628-001
17	Flow Tube, O_2, 0.1 - 8L	4114262
18	Flow Tube, Air, 0.1 - 8L	4114264
19	Restrictor, O_2, red	4110738-003

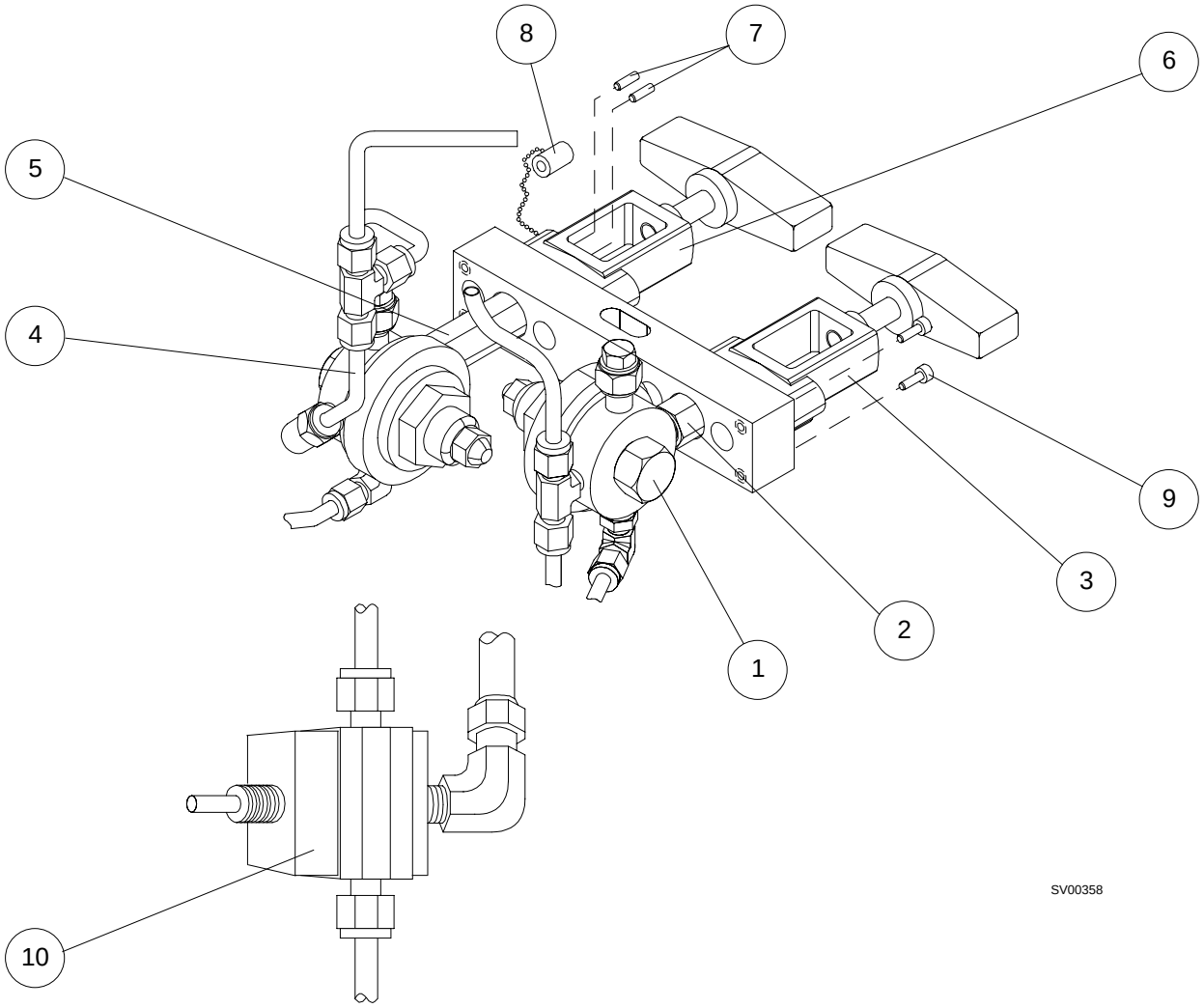
SPARE AND REPLACEMENT PARTS (continued)





ITEM	DESCRIPTION	PART NUMBER
1	Auxiliary O_2 Flow Meter Assembly	4109310
	Mounting hardware:	
	Screw, 10-32 x ⅝ in. skt hd (2x)	HW01027
	Flat Washer, #10 (2x)	HW66003

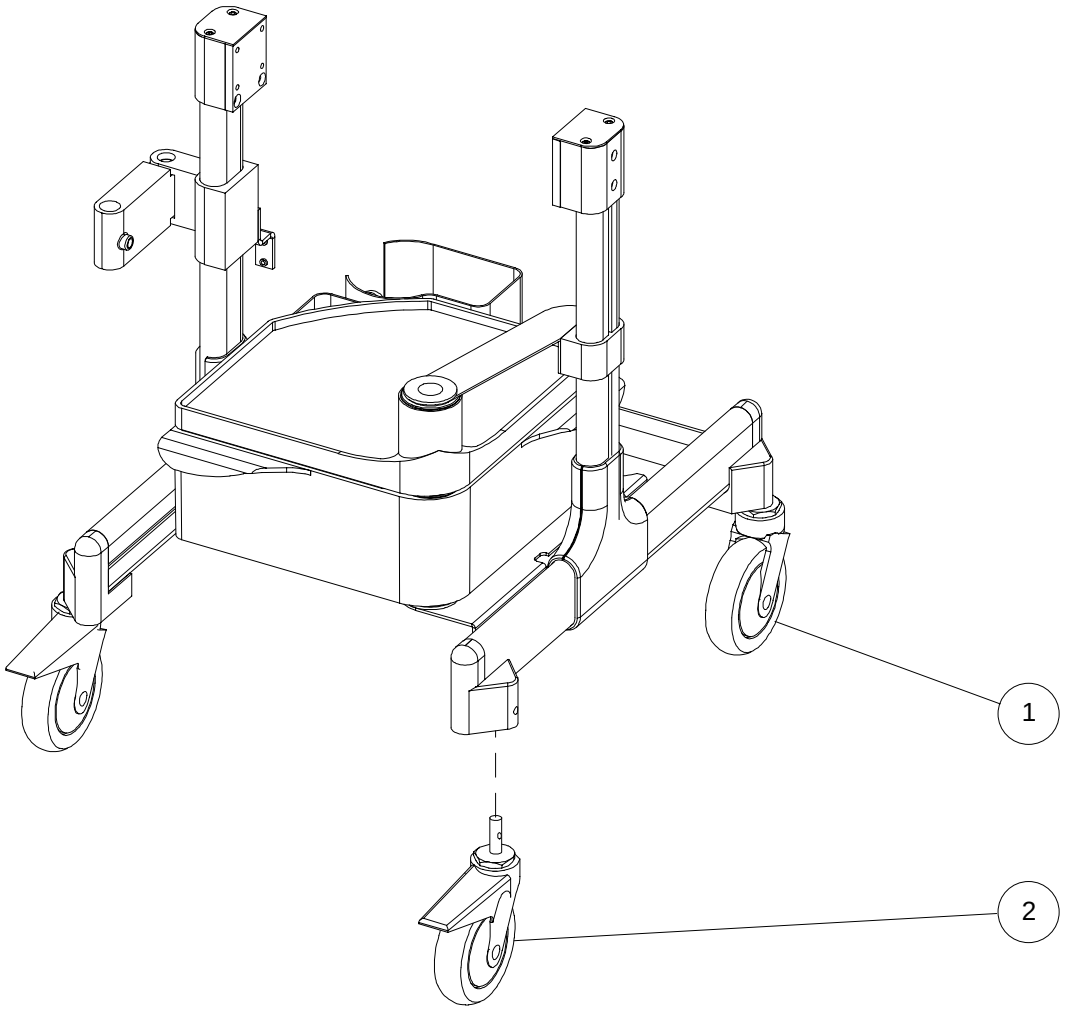
SPARE AND REPLACEMENT PARTS (continued)



ITEM	DESCRIPTION	PART NUMBER
1	O2 Regulator	4103590
2	Check valve assembly	4113932
3	O2 Yoke	1101620
4	N2O Regulator	4103591
5	Check valve assembly	4113932-002
6	N2O Yoke	1101621
7	Screw (index pin), sltd, 0.157OD x 6-32 x 0.718 L (2x per yoke)	4105929
8	Plug assembly, yoke (2x)	4112755-001
9	Screw, 10-32 x 1 in. cap skt hd (4x)	HW01096
10	O_2 Flush Valve	4103340

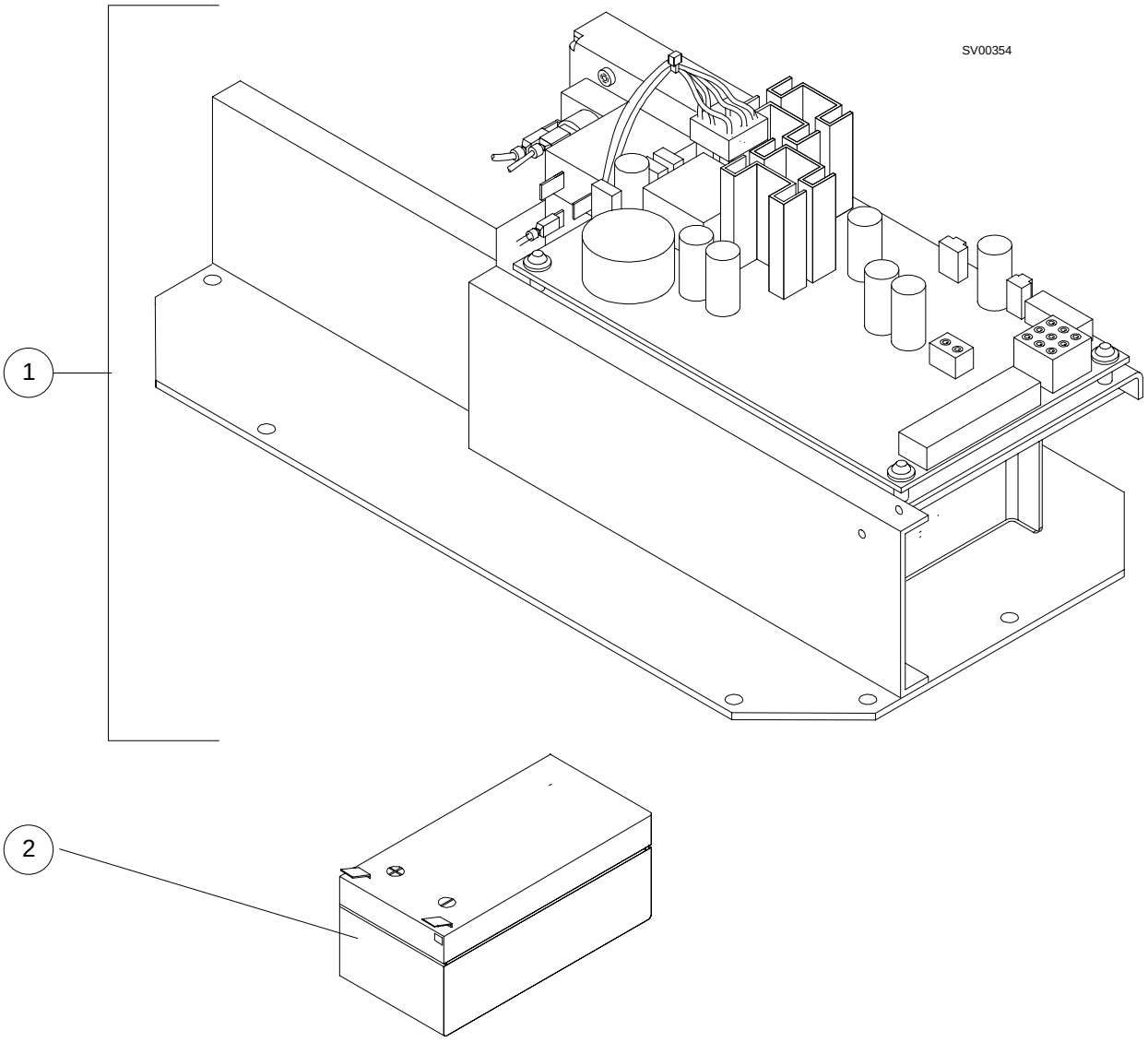
SPARE AND REPLACEMENT PARTS (continued)

SV00360



ITEM	DESCRIPTION	PART NUMBER
1	Caster w/ brake (2x)	
2	Caster w/o brake (2x)	

SPARE AND REPLACEMENT PARTS (continued)

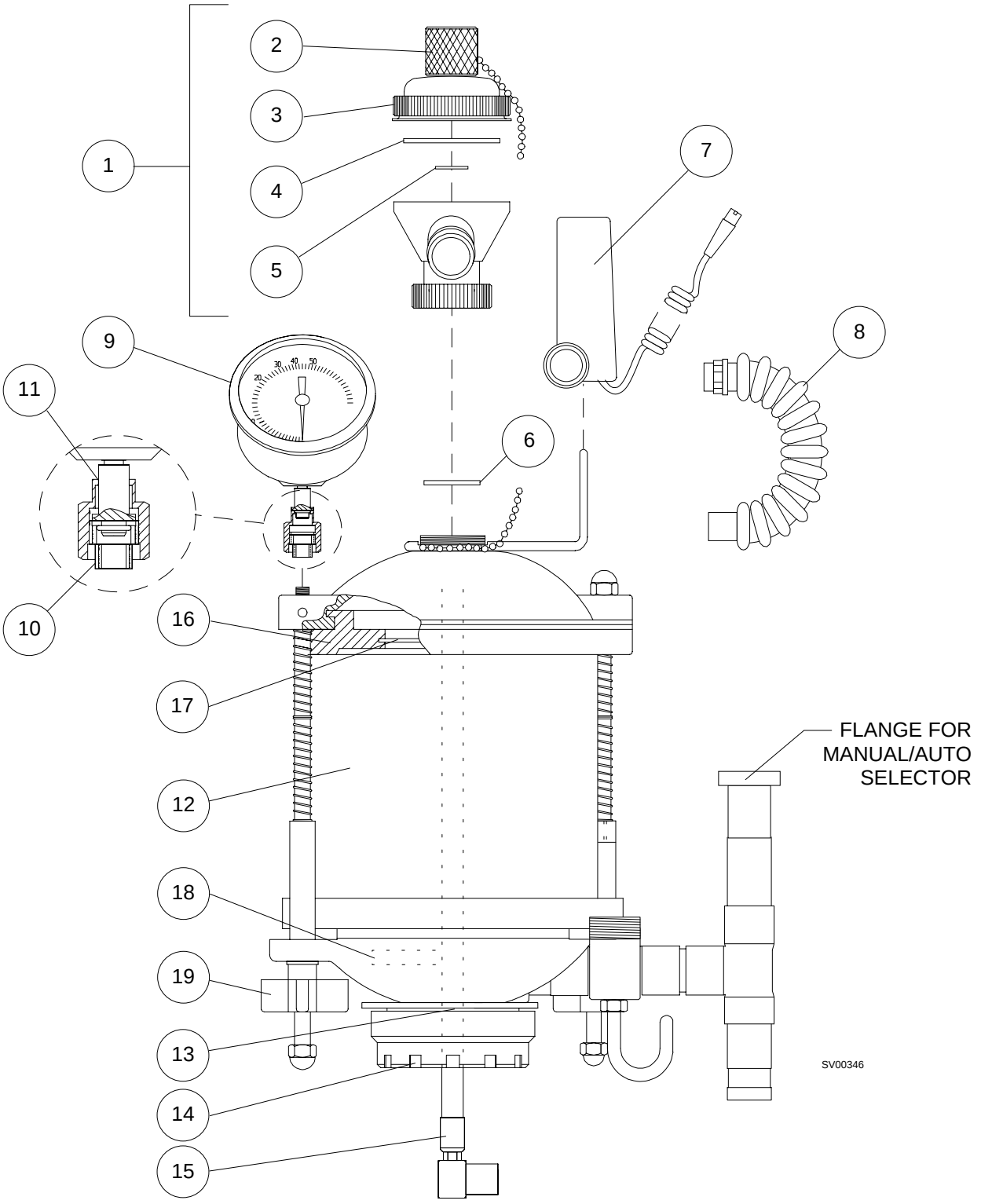


ITEM	DESCRIPTION	PART NUMBER
1	Power Supply Assembly, NMM	4114284
	PCB Assembly	4113579
	Condor Power Supply	4114523
2	Battery, 12 V rechargeable	4114229

Electrical items not shown:

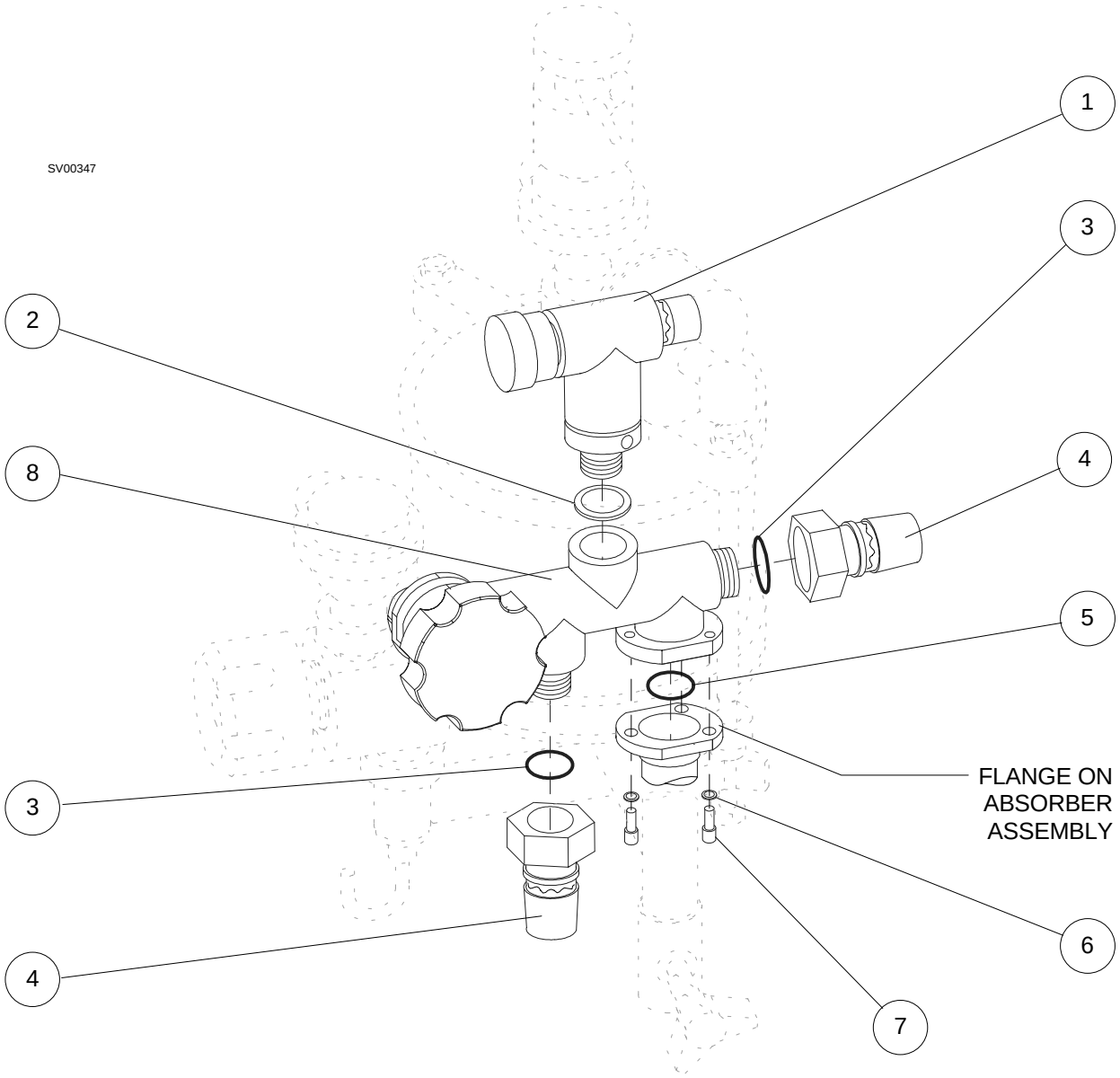
Main Cable Assembly (internal)	4114289
Lamp Assembly	4114330
Power Cord, 6 ft	4110334

SPARE AND REPLACEMENT PARTS (continued)



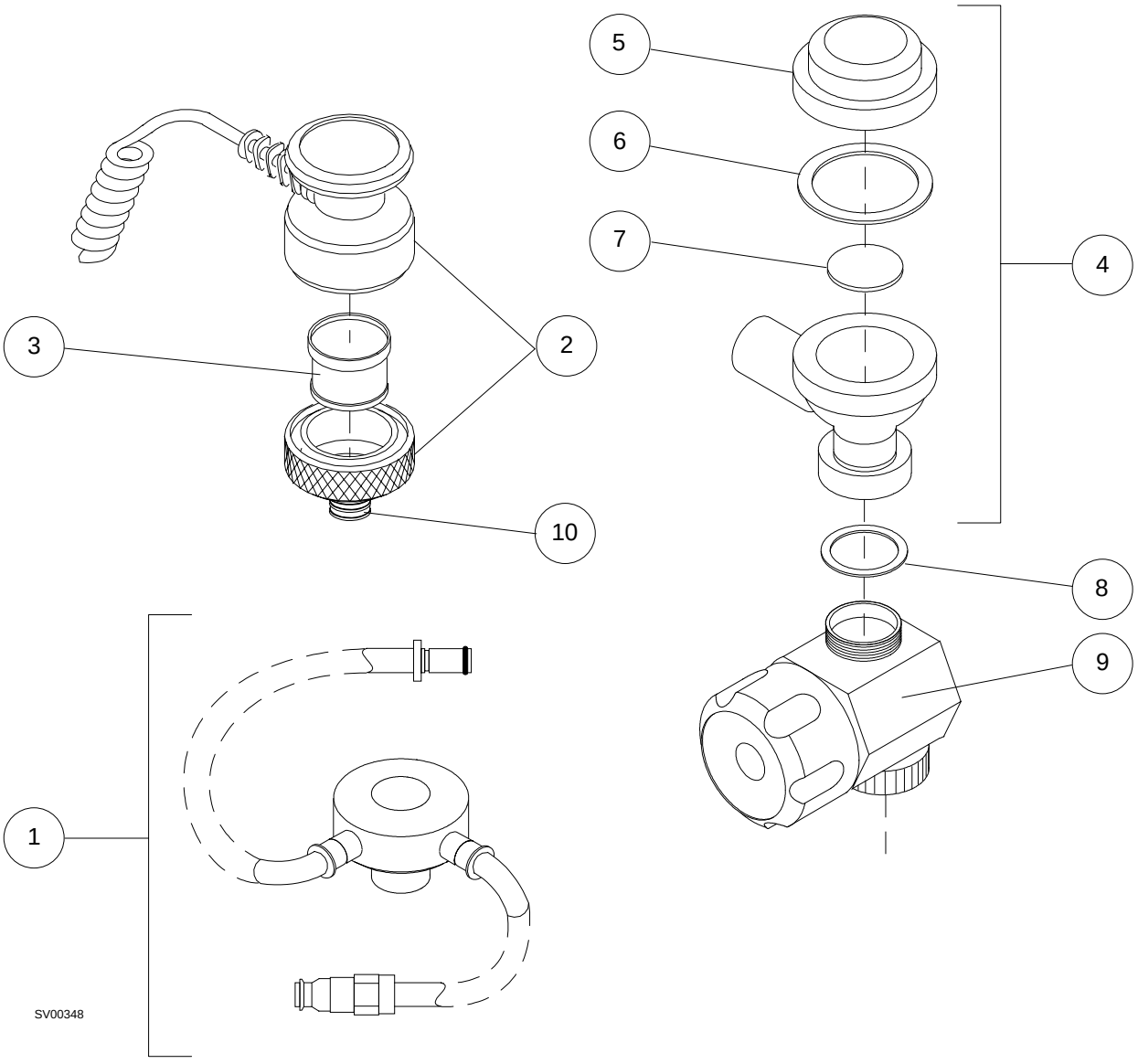
ITEM	DESCRIPTION	PART NUMBER
	Absorber Assembly	4114117
	Manual/Auto Selector Valve is shown on a subsequent page	
	Expiratory Valve, PEEP Valve and Breathing Pressure hose Assembly are shown on a subsequent page	
1	Inspiratory Valve Assembly w/O_2 sensor mount	4112773-001
2	Plug Assembly, Oxygen Sensor	4106387
3	Dome & Label, Insp. Valve	4108329
4	Gasket, Valve Dome	2109231
5	Disk	2123249
6	Gasket, Valve Mount	1101690
7	Ultrasonic Flow Sensor	4115754
	Electronics Housing (ref. only, not a spare part)	4114443
	Flow Housing	4114444
	Transducer (2x)	4114445
	O-ring, set of six	4115147
8	Connector Hose	4114912
9	Gauge Assembly, (incl. fitting for breathing pressure hose)	4114290
	Replacement Cover	4113387
	Replacement Ring	4113388
10	Gauge Mount Adapter	4114234
11	O-ring, #010 (neoprene)	4101872
12	Canister (Incl lower gasket)	4105851
13	O-ring, #335 (EPDM)	4114167
14	Dust Cup	4114094
15	Fresh Gas Hose	4108577
16	Gasket, canister top	4105848
17	Screen, canister	1100022
18	Gasket, canister bottom	4105849
19	Wing nut (2x)	4114087

SPARE AND REPLACEMENT PARTS (continued)



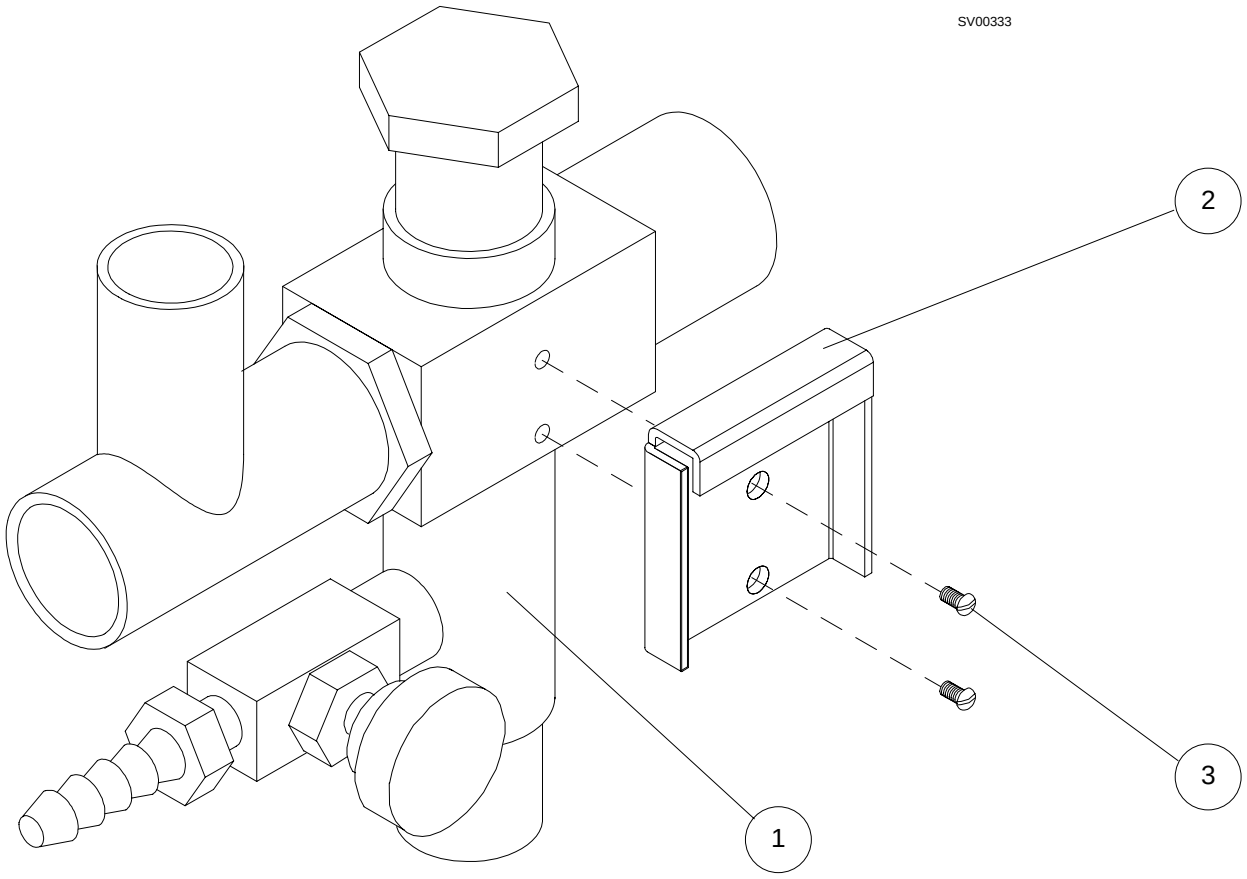
ITEM	DESCRIPTION	PART NUMBER
	Valve, Man/Auto Selector	4114165
1	APL Valve	4104839
2	Fiber Washer	(Supplied with APL Valve)
3	O-Ring, #120 EPDM (2x)	4112629-001
4	Connector, 22mm (2x)	4114093
5	O-Ring, #117 Silicone	4105766
6	Lock Washer, #8 split (3x)	HW65011
7	Screw, Selector Valve Mounting, 8-32 x 7/16 in. Skt Hd Cap (3x)	HW01013
8	Auto-Bag Valve Body	

SPARE AND REPLACEMENT PARTS (continued)



ITEM	DESCRIPTION	PART NUMBER
1	Breathing Pressure Hose Assembly	4114281
2	O_2 Sensor Housing Assembly	4106363
3	O_2 Sensor Capsule	6803290
4	Expiratory Valve Assembly	4112150
5	Dome	2109230
6	Gasket, Valve Dome	2109231
7	Disk	2123249
8	Gasket, Valve Mount (2x)	1101690
9	PEEP Valve Assembly	4114164
10	O-ring, O2 sensor housing (2x)	4106388

SPARE AND REPLACEMENT PARTS (continued)



ITEM	DESCRIPTION	PART NUMBER
1	Scavenger	4114255
2	Mounting Bracket	supplied with scavenger
3	Screw, 6-32 x ¼ in. pan hd (2x)	supplied with scavenger

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SPECIFICATIONS

General

Anesthesia machine dimensions (approx.) (W x H x D) . . . . . 23½ x 53½ x 24½ inches
Anesthesia machine weight (approx.) . . . . . .163 lbs

Environmental

Storage

Temperature . . . . . .-20 to 60° C
Humidity . . . . . .10–90% relative humidity (noncondensing)
Barometric Pressure. . . . . .787 to 523 mmHg

Operating

Temperature . . . . . 10 to 35° C
Humidity . . . . . .30–70% relative humidity (noncondensing)
Barometric Pressure. . . . . .787 to 523 mmHg

Electrical

Equipment class . . . . . .UL 2601 Class 1, Type B, continuous operation, IPXO
Leakage current. . . . . .≤ 300 microamps (UL 2601)
Ground impedance . . . . . ≤ 0.1 ohm (60 Hz source)
Dielectric withstand . . . . . ≥ 1500 VAC (UL 2601)
Chassis resistance (between any metallic point
and ground pin on power cord). . . . . .≤ 0.1 ohm

Power Supply

Primary input voltage (acceptable range). . . . . .100 to 240 VAC @ 50/60 Hz
Primary input current. . . . . ≤ 2.5 amps @ 50/60 Hz

Backup Battery

Type. . . . . Sealed Lead Acid, 12 VDC, 3.4 Ah
Charging time . . . . . ≤ 12 hours
Reserve power time (from full charge). . . . . .≥ 90 min

SPECIFICATIONS (continued)

Gas Delivery System

Pipeline inlet connections . . . . . DISS/male (ANSI B57.1-1977)
Pipeline inlet pressure . . . . . 50–55 psi (345–380 kPa) (O_2,N_2O, Air)
Pipeline gauge accuracy . . . . . ±3 psi (0–25 psi)
±2 psi (25–75 psi)
±3 psi (75–100 psi)
Cylinder connection . . . . . Pin-indexed hanger yoke (ANSI/CGA V-1-1987)
Over pressure relief valve . . . . . 95 psi (655 kPa)
Fresh gas common outlet . . . . . 15 mm female
Fresh gas oxygen concentration (ORC) . . . . . 25 ±4%
Oxygen flush flow rate . . . . . 55 (±10) L/min
Minimum oxygen flow (at 50 psi pipeline pressure) . . . . . 150 ±50 mL/min
Low oxygen supply pressure alarm . . . . . 34–40 psi
Cylinder gauge accuracy . . . . . ±90 psi (0–750 psi)
±60 psi (750–2250 psi)
±90 psi (2250–3000 psi)

Cylinder Gas Pressure

Oxygen . . . . . 1900 psi (13100 kPa) E-size cylinder (at 70° F, 21° C)
Nitrous Oxide . . . . . 745 psi (5130 kPa) E-size cylinder (at 70° F, 21° C)

Flowmeter Accuracy (at 20°C and 760 mmHg)

Oxygen, Nitrous Oxide, Air
Dual Tapered 0-8 L/min . . . . . 0.1 to 0.2 L/min ± 50 mL/min
0.2 to 1.0 L/min ±100 mL/min
1.0 to 8.0 L/min ±5% FS
Oxygen (Auxiliary Oxygen) . . . . . 0–10 L/min ±5% FS

Vaporizer (Dräger-Vapor 19.3)

Refer to the Dräger Vapor 19.3 Operator's Manual

Ventilator

Frequency . . . . . 1–99, ±1 BPM (in 1 BPM increments)
I:E ratio . . . . . *Standard range*: 1:1–1:4.5, ±0.1 (in increments of 0.5); *Extended range*: 4:1, 3:1, 2:1
Inspiratory flow . . . . . 10–100 L/min (uncalibrated)
Tidal volume . . . . . 50–1500 mL, ±100 mL
Pressure limit control adjustment range . . . . . 15–120 cmH_2O

Absorber System

Inspiratory Valve
Mounting ring nut size . . . . . M35 x 1
Hose terminal . . . . . 22 mm male

Expiratory Valve
Mounting ring nut size . . . . . M33 x 1
Hose terminal . . . . . 22 mm male

PEEP Valve
Range . . . . . approx. 2–15 cmH_2O (continuously adjustable)

APL Valve
Nominal low flow resistance . . . . . 2 cmH_2O at 8 L/min
Hose terminal . . . . . 19 mm male

Breathing Bag Connection
Bag terminal . . . . . 22 mm male

SPECIFICATIONS (continued)

Oxygen Monitoring

Range . . . . . 10–100 vol % O_2
Resolution . . . . . 1 vol % O_2
Accuracy . . . . . ±3 vol % O_2
(When calibrated within 18 hours, and constant temperature and pressure)

Response time . . . . . ≤ 25 sec (T90)
Zero drift . . . . . ≤ 0.1 vol % O_2/month
Span drift . . . . . ≤ 1 vol % O_2/8 hours
Temperature error . . . . . ≤ ± 3% of reading (15° to 40° C)
Sensor service life . . . . . ≥ 8 months at 25° C, 50% relative humidity, 50% O_2 gas mixture (or ≥ 5000% hour CO_2)

Breathing Pressure Monitoring

Numeric display range . . . . . -10 to 125 cmH_2O
Resolution . . . . . 1 cmH_2O
Accuracy . . . . . ±3 cmH_2O or ±10% of reading, whichever is greater
Waveform display range - full . . . . . 0–100 cmH_2O
Waveform resolution . . . . . 1 cmH_2O
Waveform accuracy . . . . . ±3 cmH_2O or ±10% of reading, whichever is greater
Waveform display scales . . . . . 0–20, 0–50, 0–100 cmH_2O

Respiratory Volume Monitoring

Minute Volume

Display Range . . . . . 0.2 to 50.0 L
Resolution . . . . . 0.1 L
Accuracy . . . . . ≤ +10% or 0.1 L, whichever is greater

Tidal Volume

Display Range . . . . . 0.05 to 20.1 L
NOTE: The standard bellows will deliver up to 1.5 L
Resolution . . . . . 0.01 L
Accuracy . . . . . ≤ ±10% or 0.01 L, whichever is greater
Volume Apnea Threshold . . . . . 0.05 L

Respiratory Rate

Numeric display range . . . . . 2–99 BPM
Resolution . . . . . 1 BPM
Accuracy . . . . . ≤ ±10% or ±1 BPM, whichever is greater

Serial Interface

Serial Port

Type RS-232/422
Baud Rate . . . . . 300 to 38400
Parity . . . . . Odd, Even, or None
Data Bits . . . . . 7 or 8
Stop Bits . . . . . 1 or 2
Protocol . . . . . Vitalink

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Rev. A summary of changes

Page	Description
8-33	Revised parts list for ultrasonic flow sensor

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North American Dräger

Quality Service for Life®

DrägerService℠
3122 Commerce Drive
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Part Number: 4115138-001
Rev:A
Date: 19 May 1999